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Ontario, Legislative Assembly
SESSIONAL PAPERS.

VOL. XXXII.—PART II.

THIRD SESSION, NINTH LEGISLATURE

OF THE

PROVINCE OF ONTARIO.

SESSION 1900.

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1900.



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T O R O N T O.

LIST OF SESSIONAL PAPERS.

PRESENTED TO THE HOUSE DURING THE SESSION.

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Accounts (<i>Dom. and the Provinces</i>), Awards	51	<i>Printed.</i>
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“ Report of Commission	4	“
“ Public	1	“
Agricultural College, Report	14	“
“ and Experimental Union, Report	15	“
“ and Horticultural Societies, Report	65	<i>Not printed.</i>
Amherstburg, Audit of Accounts	59	“
Asylums, Report	34	<i>Printed.</i>
Barron, Judge, O. in C.	64	<i>Not printed.</i>
Bee Keepers' Association, Report	20	<i>Printed.</i>
Binder Twine sold in 1899	72	<i>Not printed.</i>
Births, Marriages and Deaths, Report	9	<i>Printed.</i>
Blanche River Pulp Company	49	“
Blind Institute, Report	37	“
Bonuses and Exemptions, Municipal	69	<i>Not printed.</i>
Boys and Girls relieved	71	“
Cheese and Butter Associations, Report	22	<i>Printed.</i>
Children Neglected, Report	39	“
Courts, moneys in	55	<i>Not printed.</i>
Courts, Sittings of the	81	“
Crown Lands, Report	3	<i>Printed.</i>
Deaf and Dumb Institute, Report	38	<i>Printed.</i>
Division Courts, Report	29	“
Doyle, Judge, O. in C.	58	<i>Not printed.</i>
Education, Report	12	<i>Printed.</i>
Elections, Returns	42	“
Elgin West, Commission	46	“
Entomological Society, Report	19	“
Estimates	2	“
Factories, Report	8	<i>Printed.</i>
Factories, Employes in	77	<i>Not printed.</i>
Farmers' Institutes, Report	24	<i>Printed.</i>
Financial Commission, Report	4	“
Fruit Experiment Stations, Report	17	“
Fruit Growers' Association, Report	16	“
Fumigation Appliances, Report	44	“

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Game and Fish, Report	27	<i>Printed.</i>
Gaols, Prisons, etc., Report.....	35	"
Guarantee Policies	63	<i>Not printed.</i>
Health, Report.....	32	<i>Printed.</i>
Hoskin, John, salary	75	<i>Not printed.</i>
Hospitals and Charities, Report	36	<i>Printed.</i>
Immigration, Report	28	<i>Printed.</i>
Imperial Institute, Canadian Section	74	<i>Not printed.</i>
Infants, Moneys of, in Court.....	53	"
Industries, Report	26	<i>Printed.</i>
Insurance, Report	10	"
Insurance Company's, Guarantee Policies	63	<i>Not printed.</i>
Judicature Act, Judges fees under	58, 61, 62, 64	<i>Not printed.</i>
Judicature, Court of, money in, or under control of	55	"
Legal Offices, Report	30	<i>Printed.</i>
Leeds and Grenville, claim of	82	<i>Not printed.</i>
Library, Report on	45	"
License Inspectors, names of, etc.	67	"
Liquor Licenses, Report.....	40	<i>Printed.</i>
Live Stock Associations, Report	23	"
Live Stock, Registrar of, Report	73	"
Loan Corporations, Report.....	11	"
McNiven, Donald, appointment of	54	<i>Not printed.</i>
Manufacturing Industries, Bonuses to	69	"
Mavor's Report	40	<i>Printed.</i>
Mines, Report	5	"
Mines Act, regulations	56	"
Moneys in the Courts.....	55	<i>Not printed.</i>
Morson, Judge, O. in C	61	"
Municipal Auditor, Report.....	41	<i>Printed.</i>
Municipal Bonuses and Exemptions	69	<i>Not printed.</i>
Nepigon Pulp Company.....	80	<i>Printed.</i>
North Augusta License	60	<i>Not printed.</i>
Ontario Power Company, agreement	79	<i>Not printed.</i>
Poultry Associations, Report.....	21	<i>Printed.</i>
Printing and Binding, Tenders	57	"
Prisons and Reformatories, Report	35	"
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TITLE.	No.	REMARKS.
Pulp Company, Spanish River	50	<i>Printed.</i>
“ Blanche River	49	“
“ Nepigon River	80	“
Queen vs. Bole and Cahill	70	<i>Not printed.</i>
Queen Victoria Niagara Falls Park, Report	6	<i>Printed.</i>
“ “ agreement with On- tario Power Company	79	<i>Not printed.</i>
Registry Offices, Report of Inspector	31	<i>Printed.</i>
Revenue received in 1899	76	<i>Not printed.</i>
Road-making, Report	25	<i>Printed.</i>
San José Scale, Report	43	<i>Printed.</i>
Secretary and Registrar, Report	33	“
Spanish River Pulp Company	50	“
Spraying, Report of Superintendent	18	“
Statutes, distribution, correspondence	78	<i>Not printed.</i>
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Tavern and Shop Licenses Act, Report	40	<i>Printed.</i>
Thedford License	84	<i>Not printed.</i>
Titles, Report of Master	68	“
Toronto University, Reports	13	<i>Printed.</i>
Upper Canada College, Report	83	<i>Printed.</i>
Warren, Frederick, appointment of	66	<i>Not printed.</i>
West Elgin Commission	46	<i>Printed,</i>
Workmen's Compensation, Mavor's Report	40	“

LIST OF SESSIONAL PAPERS.

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CONTENTS PART I.

- No. 1.. Public Accounts of the Province for the year 1899. Presented to the Legislature, 6th March, 1900. *Printed.*
- No. 2.. Estimates (Vote of Credit) for the year 1900. Presented to the Legislature, 15th February, 1900. *Not Printed.* Estimates for the year 1900. Presented to the Legislature, 6th March, 1900. *Printed.* Estimates (Supplementary). Presented to the Legislature, 25th April, 1900. *Printed.*
- No. 3.. Report of the Commissioner of Crown Lands for the year 1899. Presented to the Legislature, 29th March, 1900. *Printed.*
- No. 4.. Report of the Royal Commission, on the Financial position of the Province. Presented to the Legislature, 6th March, 1900. *Printed.*

CONTENTS PART II.

- No. 5.. Report of the Bureau of Mines for the year 1899. Presented to the Legislature, 25th April, 1900. *Printed.*
- No. 6.. Report of the Commissioners for the Queen Victoria Niagara Falls Park for the year 1899. Presented to the Legislature 23rd April, 1900. *Printed.*
- No. 7. Report of the Commissioner of Public Works for the year 1899. Presented to the Legislature, 13th March, 1900. *Printed.*
- No. 8.. Report of the Inspectors of Factories for the year 1899. Presented to the Legislature, 6th April, 1900. *Printed.*
- No. 9.. Report upon the Registration of Births, Marriages and Deaths in the Province for the year 1899. Presented to the Legislature, 9th March, 1900. *Printed.*

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- No. 10.. Report of the Inspector of Insurance and Registrar of Friendly Societies for the year 1899. Presented to the Legislature, 6th April, 1900. *Printed.*

CONTENTS PART IV.

- No. 11.. Report of the Financial Statements made by Loan Corporations for the year 1899. Presented to the Legislature, 6th April, 1900. *Printed.*

CONTENTS PART V.

- No. 12.. Report of the Minister of Education for the year 1899, with the Statistics of 1898. Presented to the Legislature, 8th March, 1900. *Printed.*
- No. 13.. Reports of Auditor and Standing Committee on Finance for 1899-1900 of the University of Toronto. Presented to the Legislature, 10th April 1900. *Printed.*
- No. 14.. Report of the Ontario Agricultural College and Experimental Farm for the year 1899. Presented to the Legislature, 17th April, 1900. *Printed.*

CONTENTS PART VI.

- No. 15.. Report of the Agricultural and Experimental Union of Ontario for the year 1899. Presented to the Legislature, 26th March, 1900. *Printed.*
- No. 16.. Report of the Fruit Growers' Association of Ontario for the year 1899 Presented to the Legislature, 23rd April, 1900. *Printed.*
- No. 17.. Report of the Fruit Experiment Stations of Ontario for the year 1899. Presented to the Legislature, 23rd April, 1900. *Printed.*
- No. 18.. Report of the Superintendent of Spraying for the year 1899. Presented to the Legislature, 12th March, 1900. *Printed*
- No. 19.. Report of the Entomological Society of Ontario for the year 1899. Presented to the Legislature, 21st March, 1900. *Printed.*
- No. 20.. Report of the Bee Keepers' Association for the Province for the year 1899. Presented to the Legislature, 6th April, 1900. *Printed.*
- No. 21.. Report of the Poultry Associations of the Province for the year 1899. Presented to the Legislature, 23rd April, 1900. *Printed.*

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- No. 22.. Report of the Cheese and Butter Associations of the Province for the year 1899. Presented to the Legislature, 23rd April, 1900 *Printed.*
- No. 23.. Report of the Live Stock Associations of the Province for the year 1899, Presented to the Legislature, 23rd April, 1900. *Printed.*
- No. 24.. Report of the Superintendent of Farmers' Institutes of the Province for the year 1899. Presented to the Legislature, 23rd April, 1900. *Printed.*
- No. 25.. Report of the Provincial Instructor in Road Making in Ontario for the year 1899. Presented to the Legislature, 23rd April, 1900. *Printed.*

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- No. 26.. Report of the Bureau of Industries for the year 1899. Presented to the Legislature, 23rd April, 1900. *Printed.*
- No. 27.. Report of the Ontario Game and Fish Commissioners for the year 1899. Presented to the Legislature, 6th April, 1900. *Printed.*
- No. 28.. Report of the Department of Immigration for the year 1899. Presented to the Legislature, 28th March, 1900. *Printed.*
- No. 29.. Report of the Inspector of Division Courts for the year 1899. Presented to the Legislature, 12th March, 1900. *Printed.*
- No. 30.. Report of the Inspector of Legal Offices for the year 1899. Presented to the Legislature, 9th March, 1900. *Printed.*
- No. 31.. Report of the Inspector of Registry Offices for the year 1899 with statement of fees and emoluments of Registrars. Presented to the Legislature, 23rd April, 1900. *Printed.*
- No. 32.. Report of the Provincial Board of Health for the year 1899. Presented to the Legislature, 25th April, 1900. *Printed.*

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- No. 33.. Report of the Secretary and Registrar of the Province for the year 1899. Presented to the Legislature, 25th April, 1900. *Printed.*
- No. 34.. Report upon the Lunatic and Idiot Asylums for the Province for the year ending 30th September, 1899. Presented to the Legislature, 6th March, 1900. *Printed.*
- No. 35.. Report upon the Common Gaols, Prisons and Reformatories of the Province for the year ending 30th September, 1899. Presented to the Legislature, 13th March, 1900. *Printed.*
- No. 36.. Report upon the Hospitals of the Province for the year ending the 30th September, 1899. Presented to the Legislature, 28th March, 1900. *Printed.*
- No. 37.. Report upon the Institution for the Education of the Blind, Brantford, for the year ending 30th September, 1899. Presented to the Legislature, 13th March, 1900. *Printed.*
- No. 38.. Report upon the Institution for the Education of the Deaf and Dumb, Belleville, for the year ending 30th September, 1899. Presented to the Legislature, 6th March, 1900. *Printed.*

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- No. 39.. Report of the Work under the Children's Protection Act for the year 1899. Presented to the Legislature, 15th March, 1900. *Printed.*

- No. 40.. Report on the working of the Tavern and Shop Licenses Acts for the year 1899. Presented to the Legislature, 6th March, 1900. *Printed.*
- No. 41.. Report of the Provincial Municipal Auditor for the year 1899. Presented to the Legislature, 13th March, 1900. *Printed.*
- No. 42.. Return from the Record of the several Elections of the Legislative Assembly in the Electoral Divisions of West Peterborough, South Renfrew, East Elgin, West Elgin, South Brant, and East Middlesex, since the General Election of March 1st, 1898, shewing :—(1) The number of Votes polled for each Candidate in the Electoral District in which there was a contest. (2) The majority whereby each successful Candidate was returned. (3) The total number of Votes polled in each District. (4) The number of Votes remaining unpolled (5) The number of names on the Voters' Lists in each District. (6) The population of each District as shewn by the last Census. Presented to the Legislature, 20th February, 1900. *Printed.*
- No. 43.. Report of the Commission of Enquiry, concerning the operation of the San José Scale Act, 1899. Presented to the Legislature, 12th March, 1900. *Printed.*
- No. 44.. Report of the Inspector of Fumigation Appliances for the year 1899. Presented to the Legislature, 12th March, 1900. *Printed.*
- No. 45.. Report of the Librarian on the state of the Library. Presented to the Legislature, 14th February, 1900. *Not printed.*
- No. 46.. Copy of an Order-in-Council, approved by His Honour the Lieutenant-Governor the thirty-first day of January, 1900, directing that a Commission be appointed to enquire into matters connected with the election for the West Riding of Elgin, and also a copy of the Commission issued thereunder. Presented to the Legislature, 15th February, 1900. *Printed.*
- No. 47.. Copy of a Commission appointing Messieurs Hoskin, Walker and Kirkland, Commissioners to enquire into the Financial affairs of the Province of Ontario. Presented to the Legislature, 19th February, 1900. *Printed.*
- No. 48.. Report by Prof. James Mavor on Workmen's Compensation for Injuries. Presented to the Legislature, 25th April, 1900. *Printed.*
- No. 49.. Copy of Agreement between Her Majesty, represented by the Honourable the Commissioner of Crown Lands, of the one part, and the Blanche River Pulp and Paper Company, Limited, of the other part, and bearing date on the 14th April, 1900. Presented to the Legislature, 23rd April, 1900. *Printed.*
- No. 50.. Copy of Agreement with the Spanish River Pulp and Paper Company Limited. Presented to the Legislature, 13th March, 1900. *Printed.*
- No. 51.. Awards of the Arbitrators on the Unsettled Accounts between the Dominion of Canada and the Provinces of Ontario and Quebec. Presented to the Legislature, 13th March, 1900. *Printed.*

- No. 52.. Statement as to distribution of the Statutes, Revised and Sessional, for the year, 1899. Presented to the Legislature, 7th March, 1900. *Not Printed.*
- No. 53.. Return to an Order of the House of the Seventeenth day of March, 1899, for a Return shewing specifically the nature and amount of each investment now outstanding of the moneys or funds of infants and others in Court, the date when each such investment was made, the rate of interest the same bears, when and how payable, and the security held for each of such investments. Presented to the Legislature, 7th March, 1900. Mr. Carscallen. *Not Printed.*
- No. 54.. Return to an Order of the House of the Sixth day of March, 1900, for a Return of copies of all correspondence in connection with the appointment of Donald McNiven, as a fishery officer for Lake Simcoe, together with copies of all reports made by him. Presented to the Legislature, 7th March, 1900. Mr. Thompson. *Not Printed.*
- No. 55.. Return to an Order of the House of the Seventeenth day of March, 1899, for a Return shewing the total amount of moneys now on deposit in, or subject to the control and distribution of the Supreme Court of Judicature for Ontario, or either division thereof; the style of cause of each action or proceeding in which such moneys have been so paid in, and the County in which each action or proceedings was commenced, as far as practicable, together with the amount now standing to the credit of each such action or proceeding; the names of the persons by whom such payments were respectively made, and on what account, where practicable; the names of and last known addresses of the persons entitled thereto, in all cases in which no payment out of Court has been made within the last ten years, so far as appears by the books and papers in the office of the Accountant of the Supreme Court of Judicature for Ontario, and the amounts due to such persons respectively, so far as appears by the said books. Presented to the Legislature, 9th March, 1900. Mr. Carscallen. *Not printed.*
- No. 56.. Regulations *in re* Staking out Locations under Mines Act, in the unsurveyed territory of Ontario. Presented to the Legislature, 12th March, 1900. *Printed.*
- No. 57.. Reported on Tenders for Departmental and Legislative Printing and Binding, and Contract with Warwick Bro's & Rutter. Presented to the Legislature, 15th March, 1900. *Printed.*
- No. 58.. Copy of Order in Council directing the payment of Surplus Surrogate fees to His Honour Judge Doyle. Presented to the Legislature, 16th March, 1900. *Not Printed.*
- No. 59.. Return to an Order of the House of the twenty-second day of March, 1899, for a Return of copies of all papers and correspondence between any member of the Government and any individual with respect to the audit asked for by citizens of the Town of Amherstburg, of the accounts of the local collector. Presented to the Legislature, 21st March, 1900. Mr. Reid, (*Addington.*) *Not Printed.*

- No. 60.. Return to an Order of the House of the twenty-first day of March, 1900, for a Return of copies of all instructions issued by the Department to the inspector or commissioners of the County of Grenville, referring to application for hotel licenses in the Village of North Augusta in the County of Grenville, for the last four years, and all reports from the commissioners and inspector in relation thereto. Presented to the Legislature, 22nd March, 1900. *Mr. Joynt. Not Printed.*
- No. 61.. Copy of an Order-in-Council commuting the Surrogate Court fees payable to His Honour Judge Morson. Presented to the Legislature, 22nd March, 1900. *Not Printed.*
- No. 62.. Copy of an Order-in-Council respecting the payment to certain Judges mentioned therein of surplus Surrogate fees. Presented to the Legislature, 22nd March, 1900. *Not Printed.*
- No. 63.. Copy of an Order-in-Council directing that the bonds or guarantee policies of certain insurance companies mentioned therein may be given and accepted as security under the Statutes of Ontario. Presented to the Legislature, 22nd March, 1900. *Not Printed.*
- No. 64.. Copy of an Order-in-Council commuting the fees of His Honour Judge Barron as Local Master at Stratford. Presented to the Legislature, 22nd March, 1900. *Not Printed.*
- No. 65.. Analysis of Reports of District, Township, Agricultural and Horticultural Societies for the years 1887, 1888 and 1889. Presented to the Legislature, 28th March, 1900. *Not Printed.*
- No. 66.. Return to an Order of the House of the sixteenth day of March, 1900, for a Return of copies of all correspondence in connection with the appointment of Frederick Warren as Division Court Clerk in the Township of Osnabruck in the County of Stormont. Presented to the Legislature, 28th March, 1900. *Mr. McLaughlin. Not Printed.*
- No. 67.. Return to an Order of the House of the sixth day of March, 1900, for a Return shewing :—
 1st. The name and salary of each License Inspector in the Province for the year 1899, and the County for which he was appointed.
 2nd. The amount allowed each such Inspector for expenses.
 3rd. The names of License Commissioners in each License District and the amount of expenses allowed to each in the year 1899. Presented to the Legislature, 29th March, 1900. *Mr. Marter. Not printed.*
- No. 68.. Report of the Master of Titles for the year 1899. Presented to the Legislature, 4th April, 1900. *Not printed.*
- No. 69.. Return to an Order of the House of the first day of March, 1899, for a Return giving information under the following heads, respecting bonuses and exemptions to manufacturing industries granted by each municipality in the Province since the year 1870 :—1. Amount

of aid by way of absolute bonus and the names of firms or companies receiving same. 2. Amount of aid by way of loan, with names of firms or companies receiving same and the amount of such loan or loans repaid to each municipality. 3. Number of factories which have been granted exemptions from taxation in whole or in part, and approximately the amount of such exemption based on municipal assessors' estimate of the rateable property of each industry. 4. Number of firms or companies which have received municipal aid in any form, more than once. 5. Number of such firms or companies which have failed or removed from the municipalities which gave them aid by way of bonus, loan or exemption. Presented to the Legislature, 4th April, 1900. Mr. *Pattullo*. *Not printed*.

No. 70. . Return to an Order of the House of the seventh day of March, 1900, for a Return of copies of all correspondence between the Government or any member thereof, or any official of the Government and the County Crown Attorney of Elgin, or any other person, in connection with the cases of *Queen vs. Bole*, and *Queen vs. Cahill*. Presented to the Legislature, 4th April, 1900. Mr. *McDiarmid*. *Not printed*.

No. 71. . Return to an Order of the House of the twenty-sixth day of March, 1900, for a Return shewing names, or the official numbers, of Boys reprieved from the Penetanguishene Reformatory, and of Girls reprieved from the Industrial Refuge for Girls, Toronto, during the two years previous to the first February, 1900. The date when the reprieve was recommended by the Warden or Superintendent. The date when the reprieve was finally granted. Presented to the Legislature, 4th April, 1900. Mr. *Pyne*. *Not printed*.

No. 72. . Return to an Order of the House of the sixth day of April, 1900, for a Return, shewing the quantity of binder twine sold during the season of 1899. To whom sold, with names of purchasers and price *per pound* received. Shewing as well, the names of persons still indebted to the Government, and to what amount, in each case. Presented to the Legislature, 6th April, 1900. Mr. *Duff*. *Not printed*

No. 73. . Report of the Registrar of Live Stock for the year 1899. Presented to the Legislature, 9th April, 1900. *Printed*.

No. 74. . Commercial Report of the Canadian Section of the Imperial Institute. Presented to the Legislature, 10th April, 1900. *Not printed*.

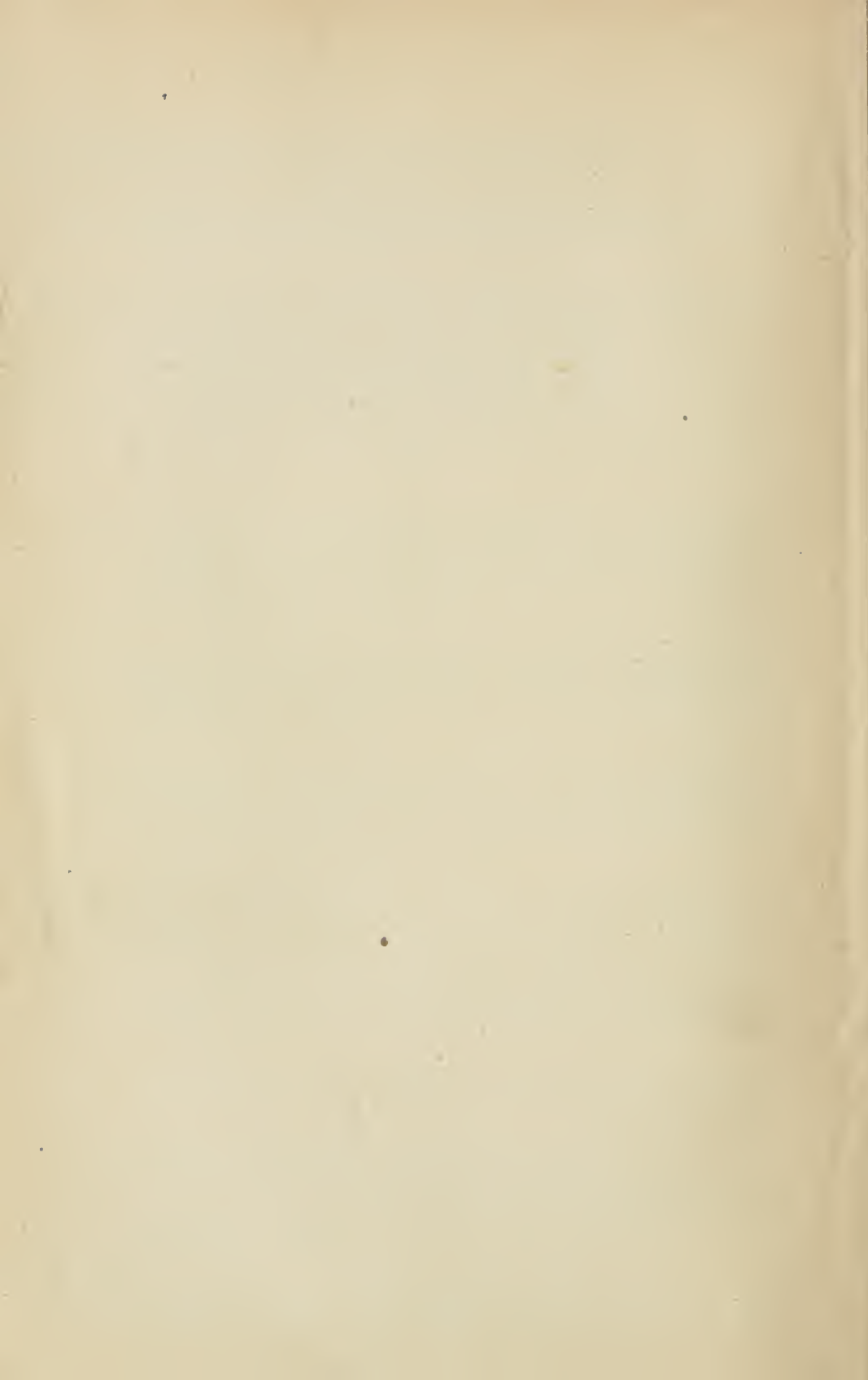
No. 75. . Return to an Order of the House of the seventh day of March, 1900, for a Return shewing the salary paid to Mr. John Hoskin as Official Guardian. The number and names of the clerks in his office with dates of appointment, and the salary paid by Government to each. Also shewing what other emoluments are received by Mr. Hoskin as such Official Guardian each year, and what amount of other emolument, if any, was so received or earned by Mr. Hoskin for the year 1899 in his capacity as such official guardian. Presented to the Legislature, 10th April, 1900. Mr. *Whitney*. *Not Printed*.

- No. 76.. Return to an Order of the House of the second day of April, 1900, for a Return shewing amount of Revenue received during the year 1899, by each of the Departments of Government as audited and passed by the Commission appointed to investigate and report as to the Finances of the Province. Presented to the Legislature, 10th April, 1900. Mr. *Miscampbell*. *Not printed*.
- No. 77.. Return to an Order of the House of the sixteenth day of March, 1900, for a Return stating the number of hours female *employés* in factories have to work each day. Also the minimum amount of wages paid *per* day to any female *employé* under the Factory Act. Also, whether separate sanitary conveniences are supplied where male and female *employés* are working, under the Factory Act. And shewing as well what system of Government inspection the factories are now under. Presented to the Legislature, 11th April, 1900. Mr. *Pyne*. *Not printed*.
- No. 78.. Return to an Order of the House of the nineteenth day of March, 1900, for a Return of copies of all correspondence between any member of the Government and any official thereof relating to the distribution of the Statutes. Presented to the Legislature, 18th April, 1900. Mr. *Carnegie*. *Not Printed*.
- No. 79.. Agreement between the Commissioners of the Queen Victoria Niagara Falls Park and the Ontario Power Company of Niagara Falls, dated 11th day of April, 1900. Presented to the Legislature, 17th April, 1900. *Not printed*.
- No. 80.. Agreement between Her Majesty, represented by the Honourable the Commissioner of Crown Lands of the first part and The Nepigon Pulp, Paper and Manufacturing Company, Limited, of the other part, bearing date on the 18th April, 1900. Presented to the Legislature, 20th April, 1900. *Printed*.
- No. 81.. Return to an Order of the House of the fourteenth day of March, 19 00 for a Return shewing the number of dates and places of sittings of the County and Districts Courts, and Courts of General Sessions of the Peace, Oyer and Terminer and General Gaol delivery and of the High Court of Justice, respectively, held in the various county and district towns of the Province, during the years 1895 to 1899, both inclusive :—
- (a) At which there has been no business to be tried before the petit jury,—
- (b) At which there has been no action, matter or other proceedings to be tried by a judge without a jury,—
- (c) At which there have been no indictments laid before the Grand Jury, Presented to the Legislature, 23rd April, 1900. Mr. *Hoyle*. *Not printed*.
- No. 82.. Return to an Order of the House of the fourth day of April, 1900, for a Return of copies of all correspondence and papers, between any member of the Government, or any official thereof, or any other person or persons, in reference to a claim made by the Counties of

Leeds and Grenville against the Government *re* Criminal Justice Account shewing as well, the balance due the Counties. Presented to the Legislature, 23rd April, 1900. Mr. Joynt. *Not printed.*

No. 83. . Report of Upper Canada College and Bursars Statement, for the year 1899. Presented to the Legislature, 26th April, 1900. *Printed.*

No. 84. . Return to an Order of the House of the ninth day of April, 1900, for a Return of copies of all correspondence between the License Commissioners or License Inspector for the East Riding of the County of Lambton, or any person, relating to the issuing of a Liquor License in the Village of Thedford for the year 1900. Presented to the Legislature, 26th April, 1900. Mr. Marter. *Not Printed.*



REPORT OF THE BUREAU OF MINES

1900

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WARWICK BRO'S & RUTTER, PRINTERS,

T O R O N T O .

TO HIS HONOR THE HONORABLE SIR OLIVER MOWAT, G.C.M.G.,
Lieutenant Governor of the Province of Ontario :

I have the honor to transmit herewith, for presentation to the Legislative Assembly,
the Ninth Report of the Bureau of Mines.

I have the Honor to be, Sir,
Your obedient servant,

E. J. DAVIS,
Commissioner of Crown Lands.

DEPARTMENT OF CROWN LANDS,
TORONTO, April 25, 1900.



TO THE HONORABLE ELIHU J. DAVIS,

Commissioner of Crown Lands:

SIR,—The Ninth Report of the Bureau of Mines is submitted to you herewith, for presentation to His Honor the Lieutenant-Governor.

I have the honor to be, Sir,

Your obedient servant,

ARCHIBALD BLUE,

Director.

BUREAU OF MINES,

TORONTO, April 25, 1900.

REPORT OF THE BUREAU OF MINES

By Archibald Blue, Director

The records of the year 1899 furnish evidence that the mining industry of Ontario continues to expand and prosper. This is shown especially in the extent to which capital is being attracted, in the purchase of mineral lands from the Crown, and in the growing volume of production.

During the year there were incorporated under the Joint Stock Companies Act 74 Companies with a capital of \$87,382,994, and in addition seven other Companies organized elsewhere were authorized by license to carry on business in the Province with a capital of \$9,551,000. The following table gives the statistics for the first 28 years after Confederation and for the last four years, inclusive of licensed Companies :

Year.	No.	Capital.
		\$
1868-95	120	46,929,389
1896	26	15,600,000
1897	140	101,531,000
1898	49	30,762,998
1899	81	96,933,994

The number organized and licensed during the thirty-two years is 416, and the amount of authorized capital is \$291,757,372. Last year's Companies make a fifth of the whole in number, and rank as second in the amount of authorized capital during the whole period, being exceeded only by the record of 1897.

The next tables present the transactions in mining lands for the last eight years, the first showing the number and area of mining locations sold and the purchase money paid therefor, and the second the number of locations leased and the amounts paid thereon as rent. Included under this latter head is the money paid each year for lands previously leased, which is a steadily growing figure :¹

¹ Although the Bureau was organized in 1891 the statistics for that year are not given in the tables, because the transactions included many locations applied for in the previous year before and during the time that lands were withdrawn from sale, and which therefore would not afford a fair comparison with the transactions of later years.

1. LOCATIONS SOLD.

Year.	No.	Acres.	\$
1892.....	65	6,500	15,273
1893.....	63	4,370	11,489
1894.....	40	3,271	7,646
1895.....	99	7,720	15,868
1896.....	140	10,734	22,084
1897.....	472	29,794	59,478
1898.....	292	19,529	40,169
1899.....	294	35,049	75,367
Totals.....	1,465	116,667	247,674

2. LOCATIONS LEASED.

Year.	No.	Acres.	\$
1892.....	95	13,122	12,917 36
1893.....	122	13,047	14,669 76
1894.....	66	7,051	10,296.56
1895.....	175	15,084	18,2 1.16
1896.....	161	13,224	18,504.14
1897.....	783	86,014	91,062.46
1898.....	506	48,911	57,493.25
1899.....	496	63,258	75,607.90
Totals.....	2,404	259,711	298,762.59

Adding the revenue from miners' licenses, etc., in the Michipicoton Mining Division for the three years 1897-9 (\$11,223.50) the aggregate revenue from mineral lands during the eight years is \$557,660.09, or an annual average of \$69,707.57. The revenue for 1899, including miners' licenses, etc., is \$155,953.90, which exceeds any former year.

The average size of locations sold during the period of eight years is very nearly 80 acres, and of locations leased 108 acres. For 1899 the average of locations sold is 119 acres, and of locations leased 127 acres, being higher than the averages for any year of the period excepting 1892, in which year the average of leased locations was 138 acres. The average of the 3,869 locations leased and sold in the eight years is 97 acres, and the aggregate is 376,378 acres, or 588 square miles.

Statistics of mineral production were incomplete for the first year of the Bureau's operations, but in the table which follows a comparison is made of the values of products in 1892 and 1899 :

Products.	1892.	1899.
Building stone, rubble, etc	\$880,000	\$1,041,350
Cement, natural rock	33,580	117,039
Cement, Portland	47,417	444,227
Lime.....	350,000	535,000
Drain tile	100,000	200,246
Common brick.....	980,000	1,313,750
Pressed brick and terra cotta.....	259,335	105,000
Paving brick .....	.....	42,550
* Sewer pipe .....	.....	138,356
Pottery	80,000	101,000
Petroleum products.....	1,400,435	1,747,352
Natural gas	160,000	440,904
Carbide of calcium.....	.....	74,680
Salt.....	162,700	317,412
Gypsum.....	25 980	16 512
Graphite .....	.....	16,179
Talc .....	.....	500
Mica	1,500	38,000
Arsenic .....	.....	4,842
Iron ore.....	.....	30,951
Pig iron .....	.....	803,157
Nickel	590,902	526,104
Copper.....	232,135	176,237
Cobalt	3,713	.....
Gold	36 900	423,978
Silver	732	65,575
Zinc .....	.....	24,000
Totals.....	\$5,350,349	\$8,789,901

The list shows that during the eight years paving brick, sewer pipe, carbide of calcium graphite, talc, arsenic, iron ore, pig iron and zinc have been introduced as new products of the mineral industry, whose aggregate value last year was \$1,140,215. Stone and

clay products have increased in value by \$1,343,186, petroleum products and natural gas by \$627,821, salt by \$154,712 and mica by \$36,500. A falling off is shown in gypsum, nickel and copper; but in the case of the two metals this result is almost certainly due to a too low estimate of selling prices at the works. There is an increase in gold and silver of \$451,921, and of all metalliferous products of \$1,195,462. The aggregate increase in the value of products in 1899 over 1892 is \$3,439,552, and in 1899 over 1898 it is \$1,554,024. Altogether the outlook for the mineral industry of the Province was never so cheering as it is now.

Statistics of metal production for the first half of the current year (1900) afford evidence of continuing progress. Several gold mills have been idle, pending development of the mines, enlargement of machinery capacity and other causes. Returns have been received from eight, which show that during the six months 22,177 tons of ore were treated. The yield was 9,983.37 ounces, worth \$156,269.84 gold and \$141.54 silver. The silver mines show a product of 12,000 tons ore, with a yield of 85,000 ounces valued at \$51,000. The arsenic product was 208,000 lb., worth \$8,980. The output of zinc was only 150 tons, estimated at \$900. Seven iron mines in the eastern parts of the Province report a yield of 9,608 tons, worth at the selling price at the mines \$19,532. One mine in the Michipicoton Mining Division, which began to produce in July, will probably show a larger output than this total for each fortnight until navigation closes. At two blast furnaces there was smelted during the first half of the year 50,538 tons ore and 8,155 tons mill cinder. The proportion of Ontario ore used was a little more than one-fourth of the whole, being 13,252 tons; but the second half of the year will no doubt show better results in this respect. The quantity of pig iron produced was 32,279 tons, the value of which is \$511,209, computed at the selling price at the furnaces. Open hearth steel begins for the first time to figure in the metallic industries of the Province. The production for the first six months was 945 tons, valued at \$25,515. The quantity of nickel-copper ore raised was 87,808 tons, and the quantity of roasted ore smelted was 100,073 tons, which yielded a matte product of 12,323 tons. The estimated metallic contents of the matte is 1,925 tons nickel valued at \$413,771, and 1,784 tons copper valued at \$165,968. The total value of metal products for the six months was \$1,353,287, or two-thirds as much as for the whole of last year.

A number of amendments have been made to the Mines Act during the Session of the Legislature of 1900, the most important of which are the abandonment of royalties on all ores, a provision to secure the refining of nickel ores in the country, and additional regulations for the health and safety of miners.

MINERAL INDUSTRIES OF ONTARIO

Statistics of 1899

In dealing with the mineral statistics of the Province for the year it is proper to take cognizance of the mining companies organized and the transactions of mining lands, as well as the figures of production, of men employed in the industry and of wages paid for labor. Records of accidents also form an essential part of mining statistics, and the nature and causes of such accidents demand inquiry in the interests alike of employers and employes, beside the purpose they serve in shaping legislation to provide for the health and safety of the men engaged in the industry.

MINING COMPANIES.

In previous reports of the Bureau lists have been published of the mining companies which have been organized in the Province under the provisions of the Joint Stock Companies Act since Confederation. These lists gave the names of all such companies, the dates of their charters, and the amounts of their authorized capital. In the list which follows for 1899 there is given in addition the head office of each company, which will be found useful in any case where communication with the office is desired.

MINING COMPANIES INCORPORATED IN 1899.

Name of Company.	Head Office.	Date.	Capital.
			\$
The Allan Gold Reefs Company of Ontario, Limited	Ottawa	16th Mar., 1899	40,000
The Atlin Mining Company of Ontario, Limited	Ottawa	19th May, 1899	400,000
The Agassiz Exploration and Mining Company, Limited	Port Arthur	31st May, 1899	1,000,000
The Atikokan Gold Development Company of Ontario, Limited	Port Arthur	15th June, 1899	1,000,000
The Anglo-American Copper Mining Company of Parry Sound, Limited	Parry Sound	3rd Nov., 1899	3,000,000
The Argenteuil Gold Mining and Milling Company, Limited	Toronto	24th Nov., 1899	999,999
The Boulder Mining Company of Ontario, Limited	Rat Portage	13th April, 1899	2,000,000
The Baltimore Copper and Gold Mining Company, Limited	London	27th May, 1899	250,000
The Black Hawk Gold Mining Company, Limited	Toronto	3rd July, 1899	498,000
The Baine Mining and Exploration Company, Limited	Toronto	31st Aug., 1899	5,000,000
The Buffalo Consolidated Gold Mining Company, Limited	Niagara Falls	13th Sept., 1899	3,000,000
The Bullion Number Two Mining Company, Limited	Rat Portage	22nd Sept., 1899	999,999
The Britannia Consolidated Gold Mining Company of Ontario, Limited	Ottawa	18th Oct., 1899	300,000
The British Colonial Mining and Development Company of Ontario, Limited	Millbridge	27th Oct., 1899	500,000
The Corona Mining Company of Ontario, Limited	Niagara	13th Jan., 1899	190,000
The Copper King Mining Company, Limited	Windsor	24th Mar., 1899	150,000
The Crackerjack Gold Mining Company, Limited	Fort Frances	31st May, 1899	1,000,000
The Cambridge Gold Mining Company of Ontario, Limited	Toronto	13th Sept., 1899	980,000
The Crown Point Mining Company, Limited	Ottawa	4th Oct., 1899	1,000,000
The Canada Nickel Company, Limited	Worthington	3rd Nov., 1899	900,000
The Dalton Gold Mining Company, Limited	Fort William	17th May, 1899	990,000
The Dupont Gold Mining Company, Limited	Ottawa	18th Oct., 1899	1,000,000
The Empire Mining Company of Manitou, Limited	Toronto	10th July, 1899	850,000
The Enniskillen Mining Company, Limited	Sault Ste Marie	12th Aug., 1899	480,000
The Fighting Chance Gold Mining Company, Limited	Mine Centre	19th April, 1899	999,000
The Gold Reserve Mining Company of Ontario, Limited	Toronto	28th Feb., 1899	99,000

MINING COMPANIES INCORPORATED IN 1899.—*Concluded*

Name of Company.	Head Office.	Date.	Capital.
			8
The Golden Crescent Mining and Exploration Company of Ontario, Limited.....	Port Arthur ..	16th Mar., 1899	1,000,000
The Gold Bug Mining Company, Limited	Mine Centre ..	16th Mar., 1899	1,200,000
The Gold Sun Mining Company, Limited.....	Windsor	13th April, 1899	250,000
The Golden Eagle Mining and Exploration Company of Ontario, Limited	Mine Centre ..	13th April, 1899	1,000,000
The Gold Leaf Mining Company of Ontario, Limited.....	Ottawa	19th April, 1899	900,000
The Galena Gold Mining Company, Limited.	Niagara Falls..	26th April, 1899	999,000
The Gananoque Gold Mining Company, Limited	Gananoque	25th May, 1899	450,000
The Great North Country Gold Mining Company, Limited.	Toronto	25th May, 1899	800,000
The Gold Quarry Mining Company, Limited	Cornwall	31st May, 1899	900,000
The Gold Bullion Mining Company of Ontario, Limited....	Fort Erie	28th June, 1899	750,000
The Guinea Gold and Copper Mining Company of Toronto, Limited	Toronto	28th June, 1899	999,000
The Gold Panner Mining Company of Ontario, Limited....	Rat Portage ..	19th July, 1899	999,999
The Gold Reefs Company, Limited	Ottawa	28th July, 1899	1,000,000
The Gold Coin Mining Company of Ontario, Limited	Mine Centre ..	31st Aug., 1899	500,000
The Guelph Mining and Development Company, Limited...	Guelph	13th Sept., 1899	999,000
The Glass Reef Gold Mining Company of Lake Manitou, Limited	Wabigoon	21st Oct., 1899	750,000
The Gold Winner Mining Company of Ontario, Limited ..	Port Arthur...	13th Dec., 1899	1,000,000
The Headlight Gold Mining and Exploration Company of Ontario, Limited	Mine Centre ..	13th April, 1899	1,000,000
The Hornblende Gold Mining and Exploration Company of Ontario, Limited	Toronto	13th April, 1899	900,000
The Hammond-Reef Consolidated Mining Company, Limited	Toronto	23rd June, 1899	5,000,000
The Hartford Gold Mining and Development Company, Limited	Toronto	13th Dec., 1899	300,000
The Island Falls Mines Company, Limited	Port Arthur ..	12th July, 1899	1,500,000
The Imperial Copper Company of Parry Sound, Limited....	Toronto	26th July, 1899	5,000,000
The John Sykes Mining and Milling Company, Limited....	Toronto	6th Jan., 1899	499,999
The Kalevala Gold Mining Company, Limited.....	Mine Centre ..	17th Dec., 1899	1,000,000
The Mikado Peninsula Gold Mining and Development Company of Ontario, Canada, Limited	Rat Portage ..	13th April, 1899	100,000
The Mines Contract and Investigation Company, Limited...	Toronto	12th May, 1899	100,000
The Montreal-Manitou Mines Company, Limited	Ottawa	6th Oct., 1899	750,000
The Minnesota Ontario Gold Mines Company, Limited	Mine Centre ..	1st Nov., 1899	2,000,000
The Mount Royal-Manitou Gold Mining Company, Limited	Toronto	24th Nov., 1899	995,000
The Northland Gold Company of Ontario, Limited	Mine Centre ..	27th Sept., 1899	1,000,000
The National Mines Investment Company, Limited	Toronto	3rd Nov., 1899	1,000,000
The Nickel Copper Company of Ontario, Limited	Hamilton	27th Dec., 1899	1,000,000
The Ontario Victoria Mining Company, Limited.....	Toronto	28th Feb., 1899	950,000
The Orion Gold Mining Company, Limited	Rat Portage ..	17th May, 1899	999,999
The Ophir Mines Development Company of Ontario, Limited	Toronto	13th Sept., 1899	1,000,000
The Parry Sound Copper Mining Company, Limited	Parry Sound ..	23rd Mar., 1899	5,000,000
The Prichard's Harbour Copper Mining and Development Company, Limited.....	Rat Portage ..	13th Sept., 1899	500,000
The Quartz Creek Gold Mining Company of Ontario, Limited	Toronto	26th April, 1899	950,000
The Rock Lake Mining Company, Limited	Sault Ste. Marie	18th Jan., 1899	1,000,000
The Randolph Gold Mining Company, Limited			
The Standard Gold Mining and Development Company of Eagle River, Ontario, Limited	Rat Portage ..	28th Mar., 1899	1,000,000
The Saint George Mines Development Company, Limited ..	Eagle River ..	28th Dec., 1899	475,000
The Standard Mica Company of Toronto, Limited	Toronto	22nd Feb., 1899	170,000
The Sudbury Copper and Nickel Company, Limited.....	Toronto	28th Mar., 1899	90,000
The Sirdar Gold Mining Company, Limited	Sudbury	3rd May, 1899	2,000,000
The Sleean-Kilo Mining Company, Limited.....	Toronto	3rd June, 1899	1,000,000
The Victor Gold Mining and Development Company of Rat Portage, Limited	Ottawa	28th Nov., 1899	7,000,000
	Rat Portage ..	8th Nov., 1899	999,999
Licensed Mining Companies.			
The Canadian Copper Company	Cleveland, Ohio.	7th June, 1899	2,500,000
The Canadian Mines Development Company of Michipicoton	London, Eng..	13th Dec., 1899	1,458,000
The Great Lakes Copper Company	Poston, Mass..	5th Oct., 1899	3,000,000
The Golden Rod Mining Company	New York	3rd Nov., 1899	100,000
The Manitou Lake Gold Mining Company, Limited	St. Paul, Minn.	26th July, 1899	1,000,000
The Northwest Ontario Mining and Development Company, Limited			
The Sailor Consolidated Mining and Milling Company of Camp McKenney, Limited	London, Eng..	16th Sept., 1899	243,000
	Toronto	6th May, 1899	1,250,000

The total number organized and chartered during the year was 74, with an authorized capital of \$87,382,994. But to this number may be added seven other companies organized elsewhere which have taken out licenses to sell stock and other securities, and all but one of which are carrying on mining operations in the Province. The authorized capital of these seven companies is \$9,551,000, which with the other companies chartered during the year make up a total of 81, with an authorized capital of \$96,933,994. The aggregate number of mining companies to which charters and licenses have been issued since Confederation is 416, with an authorized capital of \$291,757,372.

MINING LANDS.

The number of mining locations sold and leased by the Crown last year was 790, with a total area of 98,307 acres, and the amount received from sales and rentals was \$150,975 02. This sum includes \$12,981 11 derived from lands previously leased and which are subject to a yearly rent charge. Adding \$4,979 collected as fees in the Michipicoton mining division, the aggregate revenue of the mineral lands of the Province for 1899 is \$155,954 02, which exceeds the revenue of 1898 from the same sources by \$54,768 40, and the revenue of 1898 exceeded the average of the preceding six years by \$51,098 88.

The following table gives the details by districts of mineral lands sold and leased in 1899:

MINING LANDS SOLD.

District.	Sales.	Acres.	\$
Rainy River	235	27,472	57,838 25
Thunder Bay	11	1,968	3,456 25
Algoma	18	2,321	7,136 70
Elsewhere	30	3,288	6,936 17
	294	35,049	75,367 12

MINING LANDS LEASED.

District.	Leases.	Acres.	\$
Rainy River....	320	29,217	29,217 00
Thunder Bay	106	24,034	24,034 01
Algoma	25	3,758	3,758 48
Elsewhere	45	6,249	5,617 31
	496	63,258	62,626 79

MINERAL PRODUCTION.

As shown by the summary table on page 13 the total value of the mineral products of the year was \$8,789,901, which is \$1,554,024 or 21½ per cent. more than in the preceding year. The number of hands employed was 10,003 and the amount of wages paid for labor was \$2,930,100, which in number was 33 per cent. and in amount 19 per cent. more than in 1898. The largest increases are in building materials, pig iron and gold, and the largest decrease in petroleum products. Nickel and copper show less values than

in 1892, although the products were larger and market prices of the metals were higher than in that year.

BUILDING MATERIALS AND CLAY PRODUCTS.

An upward tendency is manifested in the production of building materials. In building materials proper, including stone, brick, lime and cement, the values were \$3,556,366 or \$1,107,704 more than in 1898. The value of cement rose to \$561 266, being \$184,948 more than in 1898, and nearly 80 per cent. of the whole was Portland cement. Since 1894, when this cement began to be made in the Province, the production has increased from 30,580 barrels to 222,550 barrels and the value from \$61,060 to \$444 227, and during this time the value of imports has been steadily increasing. In the last fiscal year it reached 1,300 424 cwt., valued at \$467 944, in the face of a duty of \$147,145. The value of drain tile, sewer pipe, paving brick and pottery in 1898 was \$522,152, or \$48,435 more than in the previous year.

PETROLEUM, NATURAL GAS AND CARBIDE.

These three products come under the same general class. The petroleum industry of the country is now practically controlled by one corporation, which is understood to be a branch of the Standard Oil Company. The result of the first year's operations shows a considerable falling off in quantities and values, the crude oil being less than in the previous year by 3,363 010 gallons, and the total value of refined products less by \$223,182. But the percentage of illuminating oil distilled from the crude continues to show steady improvement, it having risen from 38.67 p.c. in 1892 to 45.52 in 1898 and to 49.53 p.c. in 1899. The percentage of lubricating oil is more than 4 per cent. less than in 1892 and about the same as in the three years preceding last year. But on the other hand the percentage of all other oils has fallen from the average of the three years to the rate of 1892, being 28.8 per cent. The producing area continues to be about the same as in 1898, and no important new strikes have been reported.

During 1899 there were bored in the two natural gas fields of the Province 35 new wells, 28 of which proved to be producers. The total number of producing wells in the year was 150, being 8 more than in 1898, and the length of pipe for the delivery of gas was 341½ miles, or an increase of 26¼ miles. The number of men employed in the industry was 95, the amount of wages paid for labor was \$40,149 and the value of product \$440,904. In 1898 the amount of wages was \$31,457 and the value of product \$301,549. The companies paid to the Provincial Government last year under the provisions of 62 V. c. 8, an aggregate of \$9,362 93.

Two works were producing carbide of calcium last year, but one of them met with an accident and was a producer for part of the year only. The quantity produced therefore only shows a small increase upon the figures of 1898. A new mill is in course of construction at Ottawa, which no doubt will add materially to the extent of the business for the current year.

SALT AND GYPSUM.

The salt industry is expanding steadily, and during the past year it reached a value of \$317,412. The twelve works in operation produced 45 347 tons of fine salt, valued at \$249,157, and 11,028 tons of coarse salt, valued at \$68 255. In 1898 the total product was 59,385 barrels, valued at \$278,886, and in 1892 it was 43,387 barrels, valued at \$162,700. The recent increase in value is largely due to the fact that at some of the principal works salt of a better quality is being produced. The total number of workmen employed at the 12 salt establishments last year was 261, and the amount of wages paid for labor \$80 021.

The gypsum business does not indicate any activity, and the statistics show little or no advance upon previous years.

TALC, GRAPHITE AND MICA.

These three minerals are yet in the very early stage of development. The discovery of a deposit of excellent talc in the vicinity of Madoc has led to the opening up of a mine in that region, for which there is likely to be a good demand. At present the whole of

SUMMARY OF MINERAL PRODUCTION IN 1899.

Product.	Quantity.	Value.	Employers.	Wages.
		\$		\$
Building stone, rubble, etc .....	.....	1,041,350	1,824	535,000
Cement, natural rock..... barrels.	139,487	117,039	} 510	163,288
Cement, Portland	222,550	444,227		
Lime	bushels 4,342,500	535,000	990	200,400
Drain tile.....	number. 21,027,400	240,246	} 3,416	630,486
Common brick	" 233,898,000	1,313,750		
Pressed brick and terra cotta	" 10,808,000	105,000	} 186	59,068
Paving brick.....	" 5,300,000	42,550		
Sewer pipe .....	.....	138,356	85	30,351
Pottery .....	.....	101,000	123	39,250
Petroleum	Imperial gal. 23,615,967	.....	} 491	214,171
Illuminating oil.....	" 11,697,910	1,059,485		
Lubricating oil	" 2,087,475	189,294		
Benzine and naptha	" 1,394,530	148,963		
Gas and fuel oils and tar	" 5,410,915	213,544		
Paraffin wax and candles	lb. 2,792,766	136,066	} 95	40,149
Natural gas .....	.....	440,904		
Carbide of calcium.....	tons ¹ 1,064	74,680	48	23,828
Salt	" 56,375	317,412	261	80,021
Gypsum and products of.....	" 1,200	16,512	25	9,500
Talc	" 100	500	3	135
Graphite	" 1,220	16,179	20	8,000
Mica	" 266	38,000	81	24,565
Iron ore	" 16,911	30,951	87	16,463
Pig iron	" 64,749	808,157	200	79,869
Nickel	" 2,872	526,104	} 839	443,879
Copper	" 2,834	176,237		
Zinc.....	" 1,200	24,000	63	13,636
Arsenic.....	lb. 113,937	4,842	5	2,250
Gold	oz. 37,727	423,978	611	286,797
Silver.....	" 105,467	65,575	40	29,000
Totals.....	.....	8,789,901	10,002	2,930,100

¹ Net tons of 2,000 lb.

the output is being shipped to New York State, to be milled there, but it is not unlikely that Canadian capital will be found to operate the mine and prepare the product for market at home.

The graphite mine in Brougham is proving to be a large body and the mineral is of excellent quality. If the claims made by manufacturers of the superior value of graphite as material for the manufacture of inks and varnishes are substantiated by time tests, a new and important use of the mineral will be assigned to it in the arts.

The production of mica last year shows a substantial improvement upon that of the previous year. As an insulator of electricity mica has come extensively into use during recent years, and the demand for it continues active. But the employment of the poorer grades as material for the manufacture of pipe and boiler coverings appears to be destined to give an assured success to the owners of mica mines, as it furnishes them a market for a large portion of product which hitherto was thrown into the dump heaps. The company which was organized in Toronto a few years ago to manufacture boiler covering from scrap mica has now a second factory in operation in Montreal, and experiments conducted by officers of the British navy and by a number of railway companies in Great Britain, Canada and the United States have been so uniformly satisfactory as to leave no doubt of the value of mica as one of the best and cheapest of all non-conductor materials.

IRON ORE AND PIG IRON.

Eight iron mines worked on a moderate scale in the counties of Hastings, Frontenac and Lanark last year yielded 16,911 tons of ore, worth \$30,951 at the selling price of ore at the mines. In 1898 the production was 27,409 tons, valued at \$48,875. In that year the mines employed 100 men whose aggregate of earnings was \$26,700. Last year the number of workmen employed was 87, and the amount of wages paid for labor \$16,463. The year 1900, however, will show more hopeful results and very substantial increase of production.

The statistics of pig iron denote satisfactory development since the operations of the first furnace began four years ago. The following figures give the details of the industry for the four years :

Schedule.	1896.	1897.	1898.	1899.
Ore smelted tons	51,138	37,492	77,023	110,036
Scale and mill cinder	5,883	5,350	8,614	10,004
Limestone for flux	8,657	9,473	13,799	25,361
Coke for fuel	30,348	27,810	50,407	74,403
Pig iron product	28,302	24,011	48,253	64,749
Value of product	\$ 353,780	288,128	530,789	808,157
Wages for labor	47,000	40,000	61,476	79,869
Average workmen	No. 125	130	130	200

The quantity of Ontario ore smelted last year was 24,494 tons, or 22 per cent. of the whole. In the previous year it was 20,968 tons, which was 27 per cent. of the whole. The increase in the production of pig iron was 16,496 tons, or 34 per cent. ; but owing to the improved market for iron the increase in value was \$277,368, or 52 per cent. There was also an increase of 70 in the average number of workmen employed at the furnaces, and an increase of \$18,393 in the amount of wages paid for labor.

After a successful career of four years the Hamilton blast furnace has passed this year into the hands of a new proprietary. The Hamilton Steel and Iron Company was organized on the first of January with a capital of \$2,000,000, and took over the plants of the Hamilton Blast Furnace Company and the Ontario Rolling Mill Company, the agreement being that the new company should build a steel plant and mill for rolling steel and operate the blast furnace, the old rolling mill and the nail factory connected with it. The site of the steel mill is east of the blast furnace about 150 yards. Its dimensions are 75 by 200 feet, and the framework is covered with corrugated iron. The plant consists of two open hearth furnaces, constructed of steel and lined with fire brick. As first planned, one was an acid-lined and the other a basic-lined furnace ; but a short experience showed that the latter was the best suited for the company's requirements, and both furnaces are now basic-lined. The charges are fed through three doors by an

electric charging machine, and each charge consists of about 15 tons of scrap, pig iron, ore, limestone, ferromanganese, etc. The fuel is supplied by four gas generators, and the capacity of each furnace is 40 to 45 tons of steel per day. An electric movable crane moves materials from any point to any point in the mill, and proves itself to be a very economic arrangement. The rolling mills adjoin the steel mill upon the east, and are under construction.

A. T. Wood, M.P., is president of the new company, O. S. Wilcox is general manager, Robert Hobson is assistant general manager and secretary, and W. A. Child is treasurer.

The Deseronto furnace is excellently situated about half a mile south of the town on the shore of the Bay of Quinte, with ample depth of water for shipping at the end of a short pier. The dimensions of the furnace are: Height, 51' 3"; diameter at hearth, 5' 11"; diameter at boshes, 9' 6"; diameter just below bell, 5' 6". The average output is 35 tons per day. The blast is supplied by a blowing engine with 24"x48" steam cylinder, and 45" square air cylinder; the downcomer is 40" diameter, branching into two parts which fire the boilers on the one hand and the hot blast stove on the other. The latter consists of seventy-two V-shaped cast iron pipes 9' high and 5"x8" in section; these are so arranged that the burning gas plays over their outer surface while the blast is passing inside; the temperature of the latter is raised to 925°. The blast passes from the blowing engine at a pressure of 2½ lb. per sq. in. to a circular receiver 8' x 15', from which it issues by a 16" pipe which forks into two branches entering the hot stove. The cast house is 98' x 43' in plan, the hot stove 17' x 20'; elevator shed 46' x 43'. There are two new boilers and one second hand boiler aggregating 250 h.p.; two pumps, 10" x 10" and 5" x 4" x 6" for supply to water jackets, two boiler pumps and other accessories. A 25 h.p. Westinghouse engine drives a Junior Westinghouse dynamo which supplies current for lighting, and a 9½" x 12" engine operates the elevator and crusher.

The ore is wheeled from the stock pile to the crusher house. If fine enough it is shovelled directly into the buckets of a belt conveyer; if too coarse, it is first passed through a Blake crusher and then elevated to the bin in a similar manner. For unloading, a trestle 448 ft. long extends into the lake. The track is 40 ft. above water level, and the extreme height is 77 ft. There are three hoists made by McMyler, Cleveland, affording ample facilities for rapid unloading. The track runs from the trestle in a new stockhouse 206' x 90' which will be completed during the summer. A new storehouse for charcoal 78' x 23' in plan has just been built in order that a sufficient stock maybe always on hand.

The furnace shell was built by Marsh & Henthorn, Belleville; the trestle by the Peninsular Bridge Co., Detroit; and the engine, pumps, jackets and some other parts belonged formerly to the Union Iron Co. of Detroit.

The charcoal is supplied by the Standard Chemical Co., whose works are distant about half a mile, and by the use of this fuel an excellent series of grades of pig iron is produced much lower in sulphur than the metal from a furnace using coke.

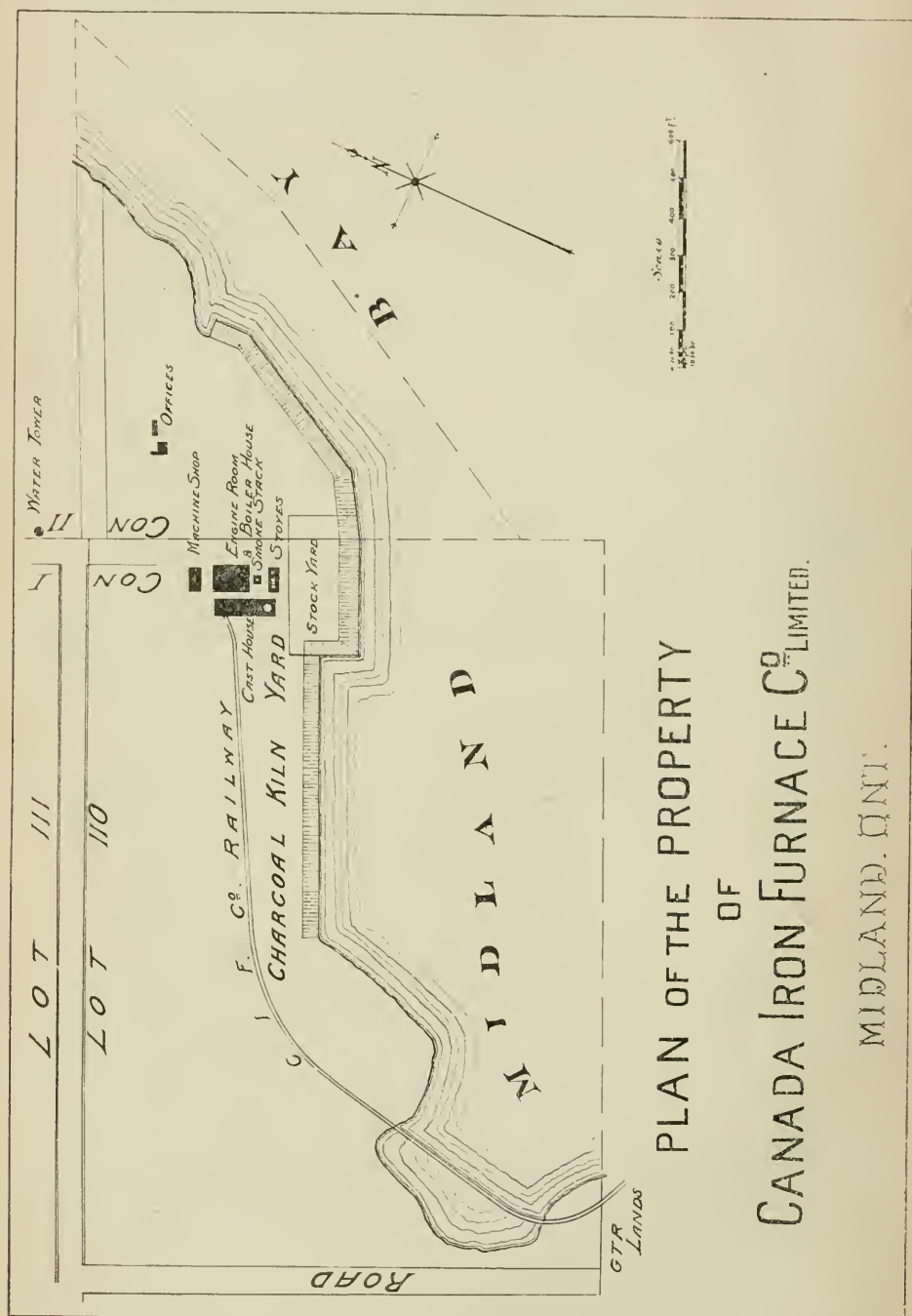
Lake Superior ore has been used chiefly, but during the latter part of 1899 and the beginning of the present year about 600 tons of Canadian ores have been smelted. At present magnetite from the Belmont mine is being used in small quantities, and it is hoped that the output of Ontario ore will increase rapidly to obviate the necessity for importing such large amounts. The remarks of Inspector DeKalb on Iron Mines and Blast Furnaces in his report on the Mines of Eastern Ontario may be read with profit in this connection.

Under the provisions of the Mines Act for the encouragement of iron mining, the company will be entitled to a payment from the Provincial Treasurer of fifty cents per ton of pig metal produced from ores not mined in Ontario, and one dollar per ton of pig metal when Ontario ores are used, provided that charcoal fuel is used in the furnace and that the following proportions of Ontario ores are smelted with the foreign ores:

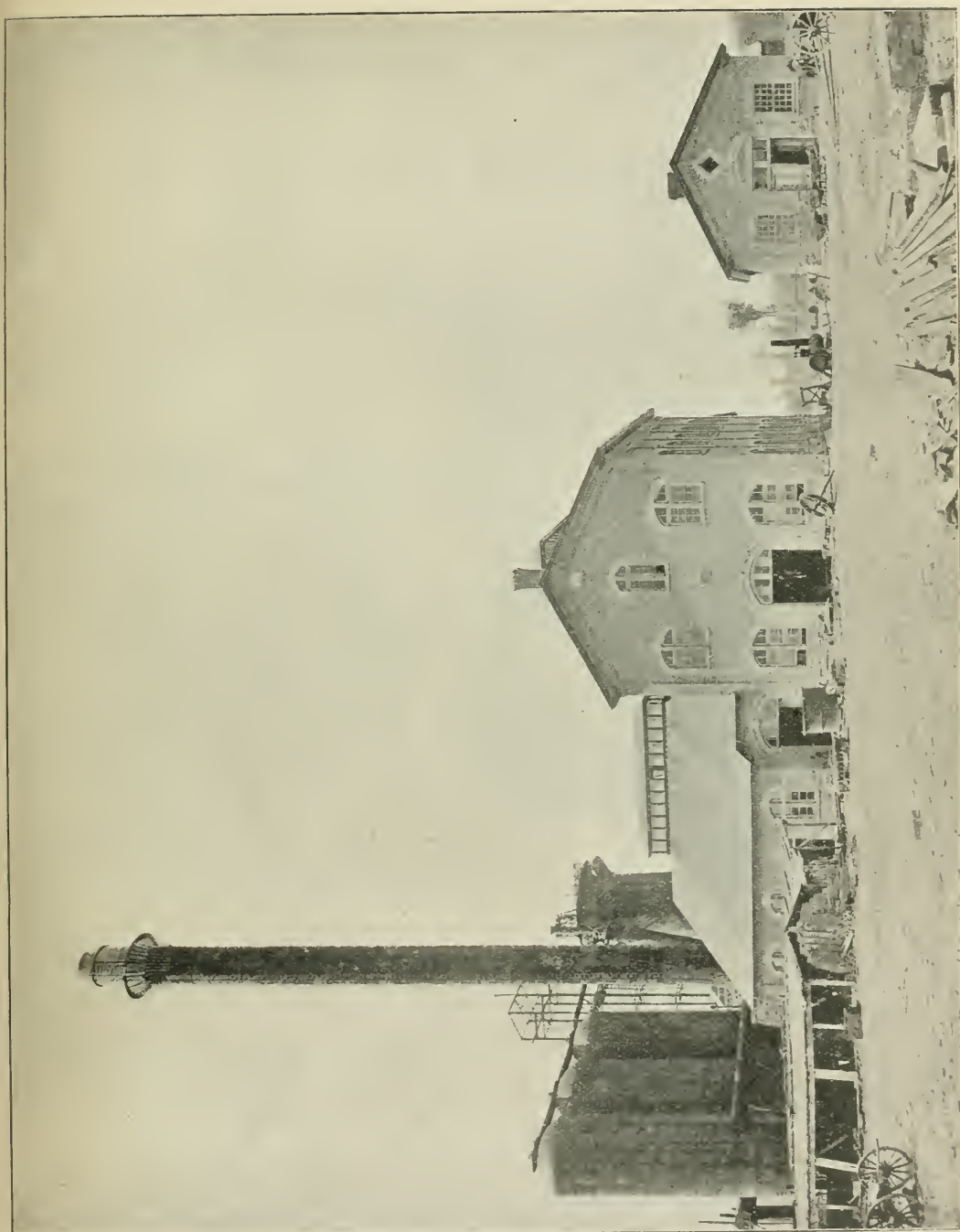
- (a) In first period of two years, not less than twenty per cent.
- (b) After two years, not less than forty per cent.
- (c) After four years, not less than sixty per cent.
- (d) After six years, not less than eighty per cent.
- (e) After eight years, not less than one hundred per cent.

If the proportion of Ontario ores in any year fall below that specified above, a percentage of the payment corresponding to the percentage of deficiency in Ontario ores will

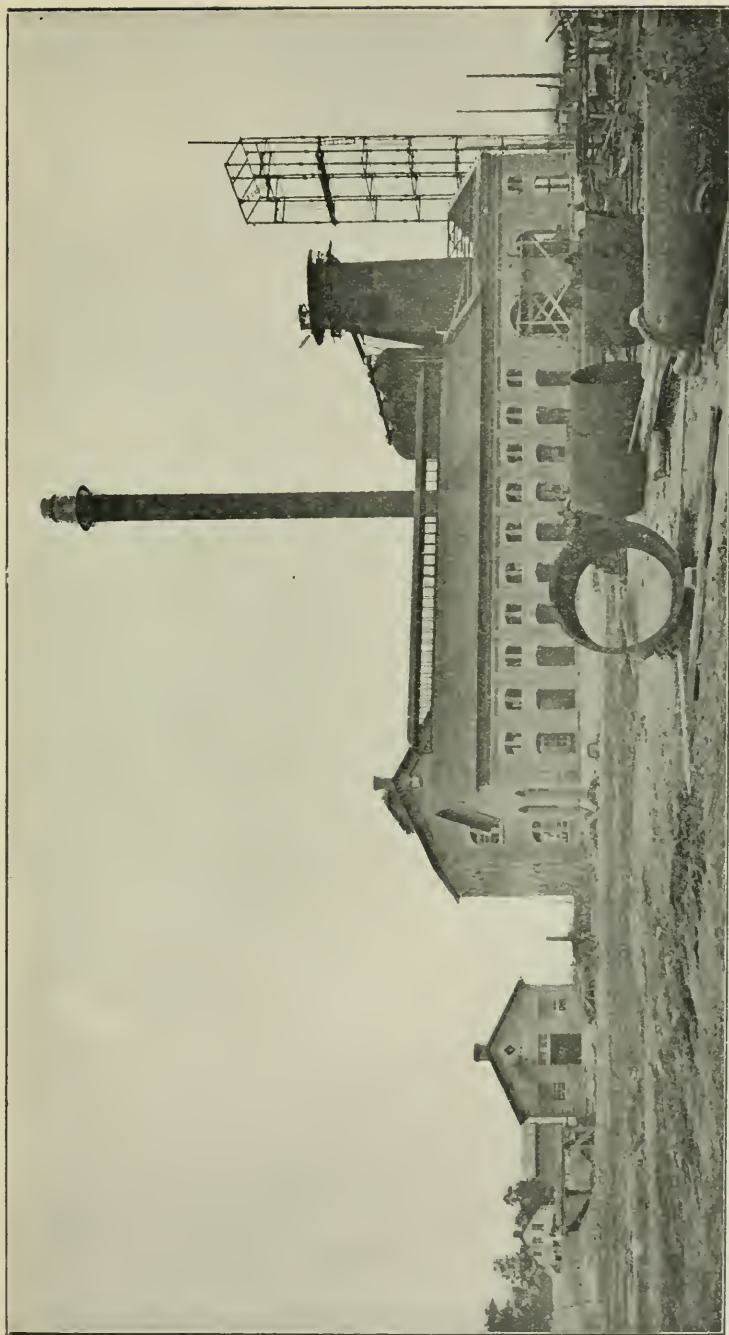
be deducted therefrom, and if the percentage of Ontario ores fall below twenty per cent. in any year no payment will be made for the metal produced from ores not mined in Ontario; and of course no claim can be made unless charcoal fuel is used.



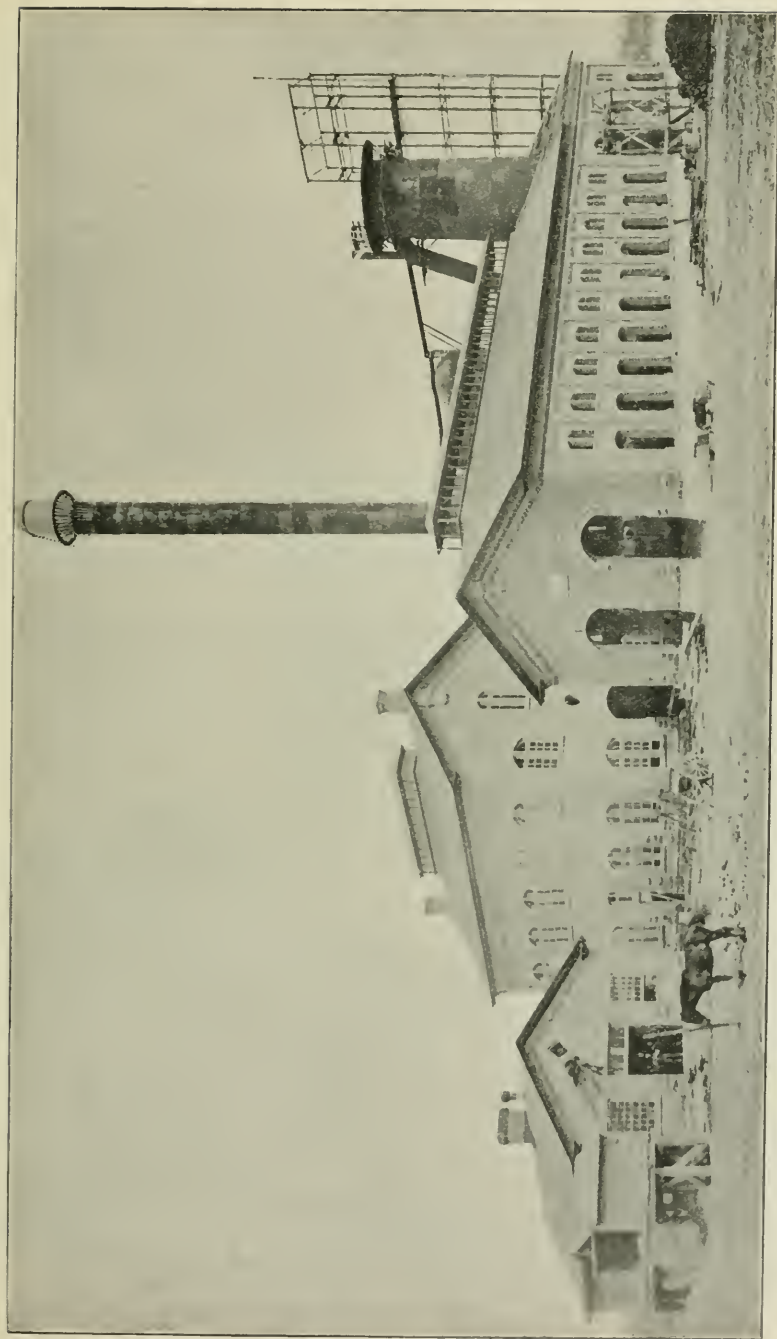
A new furnace, in course of erection by the Canada Furnace Company of Montreal, will be blown in during the present year. The location of it is on the northwest side of Midland harbor, at the town of Midland. The property consists of about fifty acres, and



1. Canada Iron Furnace Company's Works, Midland, showing Stoves, Boiler and Engine Rooms and Machine Shop. pp. 16, 102.



2. Canada Iron Furnace Company's Works, Midland, showing Office, Machine Shop, Engine Room and Cast House, with Smelting Stack and ore and Fuel Elevator, pp. 16, 102.



3. Canada Iron Furnace Company's Works, Midland, showing Machine Shop, Engine Room and Cast House, pp. 16, 102.



4. Canada Iron Furnace Company's Works, Midland, showing Cast House, Elevator and Stoves, pp. 16, 102.

extends 3000 feet along the shore line, where the water will accommodate vessels of twenty feet draft. The buildings consist of a cast house 42' x 165', an engine house 40' x 63', a boiler house 58' x 76' and a machine shop 30' x 65'. The foundations are of Portland cement and the superstructures of granite and brick. The chimney is a steel stack $8\frac{1}{2}'$ diameter and 170' above the yard level. It rests on a base of concrete and granite $24\frac{1}{2}'$ square, built to a height of 26'. The furnace stack rests on concrete faced with granite $32'$ square at the base and $24'$ square at the top. The outside measurement of the stack is 19' diameter, and it is supported by eight columns of cast iron. Power is supplied by eight boilers of 70 h.p. each, driving two engines, and there are three ovens of $16' \times 60'$ to produce hot air for the blast.

The diameter of the furnace stack at the hearth is 8', at the bosh 13', and at the throat 10'. The capacity of the crucible is 352 cubic feet and of the bosh 912 feet. The blast is fed through eight tuyeres. The steam cylinders of the blowing engines are 34" and the air cylinders 72", with a stroke of 48". At 35 revolutions the two engines will supply 15,000 cubic feet per minute, and at 40 revolutions they will supply 17,000 cubic feet. This is with allowance for loss, the nominal horsepowers being respectively 616 and 704. The furnace will have a capacity of 150 tons of pig iron per day.

The whole works have been planned by John J. Drummond, the Company's general superintendent, and they are being carried to completion under his direction. The president of the Company is P. H. Griffin of Buffalo, who is one of the largest makers of car wheels in the world. T. Guildford Smith of the same place is vice-president, and George E. Drummond and Thomas J. Drummond of Montreal are respectively managing director and secretary.

At the start of the Midland works the capital stock of the Company will be \$500,000 paid up, together with \$200,000 of five per cent 20-year gold bonds. Its properties embrace the Radnor Forges enterprise in Quebec, together with timber limits, water powers, limestone quarries and 100,000 acres of bog ore lands in that Province. The sales agents are Drummond, McColl & Co. of Montreal, who, having the benefit of direct connection with the car wheel shops at Hamilton and St. Thomas in Ontario and at Lachine in Quebec, besides being largely interested in the manufacture of cast iron gas and water pipes at Lachine and Londonderry, N. S., are in a position to find a ready market for the output of the new furnace. It is expected that at first the bulk of the supplies of ore will come from Michipicoton.

Two other blast furnaces are projected in the Province, one to be located at Collingwood and the other at Kingston; but neither of these projects have yet taken substantial shape.

NICKEL AND COPPER.

In the eight years 1892-99, for which complete statistics are available, the quantity of nickel and copper ores smelted and reduced to matte in the Sudbury district was 763,082 tons, and the estimated metallic contents were 36,449,000 lb. nickel and 40,338,500 lb. copper. At the selling price of matte at the furnaces, which is the form in which it is exported to the refineries, the total value of the nickel product in the eight years was \$3,295,000 and of the copper \$1,480,000, or a total of \$4,775,000. But at the average selling price of the metals during the eight years the value of the refined metals would be \$12,696,000 for nickel and \$4,657,000 for copper, or a total of \$17,353,000. The total amount paid for wages in Ontario during the eight years was \$2,334,000, and this makes up a large proportion of the expenditure for all purposes in our Province for the production of matte. After allowance is made for the cost of explosives, fuel and other supplies, a large part of the remaining \$2,441,000 which makes up the selling value of the matte at the works must be placed to the credit of profits and the bounty of Nature. It is certain therefore according to these statistics that the share of the value of the refined metals distributed outside of Ontario for wages, services and profits during the eight years has not been less than \$12,578,000, or 72 per cent. of the whole.

The total quantity of ore raised last year was 203,118 tons, and the total quantity smelted 171,230 tons. The following table gives the statistics for the five years 1895-99, according to the returns made to the Bureau :

Schedule.	1895	1896	1897	1898	1899
Ore raised tons	75,439	109,097	93,155	123,920	203,118
Ore smelted "	86,546	73,505	96,094	121,924	171,230
Ordinary matte "	12,525	9,733	13,706	21,101	19,109
Bessemerized matte .. "	103 ¹ / ₂	.....	328	.....	106
Nickel contents "	2,315 ¹ / ₂	1,948 ³ / ₂	1,999	2,783 ³ / ₂ ¹	2,872
Copper contents "	2,365 ¹ / ₂	1,868	2,750	4,186 ³ / ₂	2,834
Value of nickel \$	404,861	357,000	359,651	514,220	526,104
Value of copper "	160,913	130,660	200,067	268,080	176,236
Wages paid "	209,960	247,151	253,226	315,501	443,879
Men employed .. number	444	485	535	637	839

With an increase of nearly 50,000 tons in the quantity of ore smelted, the nickel contents in 1899 exceed those of 1898 by less than 100 tons, and the copper contents are actually less by 1350 tons. These figures should be verified before any attempt at comparison is made with them.

The statistics of labor show that there were employed at the mines and works last year underground 278, and above ground 536, with 25 boys under 16 years of age above ground, and that the total amount of wages paid for labor was \$443,879.

ARSENIC AND ZINC.

These are two of the most recent additions to the metallic productions of the Province. Arsenic is a content of the mispickel ores of Hastings county, and is one of the bye-products of gold mining. Zinc is found also in the same county, but the largest deposits are on the north shore of lake Superior, where a mine was opened last year.

GOLD AND SILVER.

Gold was produced last year at 15 locations, being two less than in the previous year; but there was a considerable increase in the number of men employed and in the amount of wages paid for labor, as well as in the gold product of the mines. The following table gives the statistics of gold mining in the Province for the last five years :

Schedule.	1895	1896	1897	1898	1899
Mines worked .. number.....	8	8	9	17	15
Men above ground "	126	103	222	296	307
Men under ground "	111	86	216	284	356
Ore treated..... tons.....	6,500	13,292	27,589	57,895	59,615
Gold product..... oz.....	3,038	7,154	11,412	16,261	27,594
Gold value..... \$.....	50,781	121,848	190,244	275,078	424,568
Wages paid for labor..	56,234	91,210	217,766	290,919	324,024

A great deal of development work was carried on during the year of which no account is taken in this table, which deals with bullion-producing mines only. It may also be stated that a large proportion of the wages paid for labor is properly a charge against capital, as it has been expended in opening up the mines. But it will be noticed that for the first time in the period of years the value of the gold product exceeds the amount paid for labor.

¹ By a printer's error the nickel contents for 1898 were given as 2,283³/₂ tons instead of 2,783³/₂ tons. But there is a strong probability of errors in the returns of nickel and copper contents for the last two years.

The next table gives the statistics of silver mining for the two years 1898 and 1899 :

	1898	1899
Ore raised tons	6,600	8,000
Ore stamped "	5,600	8,000
Bullion product..... oz.	86,600	105,467
Value of bullion \$	51,960	65,575
Wages paid for labor "	28,430	29,000
Average workmen above ground.....number	32	23
Average workmen underground "	27	17

Better results may be expected in silver as well as in gold mining as capital is invested and expended for exploration and development work. The experience already gained proves that the Province has important resources in the precious metals.

CORUNDUM.

Prof. Willett G. Miller was unable to do any systematic field work in 1899 on account of his time being taken up in connection with the milling of corundum rock and the preparation of material for the Paris exhibition. An account of the results of the mill work and of the tests on corundum made by a number of manufacturers was added to the last Report. As the results of economic interest were given in that Report it is not necessary to repeat them here. It may be added, however, that all the refined corundum which has been distributed since that time has been found by manufacturers to be of first class quality, and a considerable demand has arisen for the Ontario material. This demand will be supplied in the near future, as the works of the Canada Corundum Company which are being erected in the township of Raglan are nearing completion. The machinery which is being placed in this mill is of the latest and most approved designs, and since a very careful study has been made of the methods of treatment of the Ontario rock it is believed that the plant being erected will be found to be well adapted to the work it is required to do. As the corundum industry is a new one in this country it was necessary to go slowly at first and make a careful study of the subject before erecting a plant. Now, however, it is felt that those in charge of the work have obtained all the information on the subject possible to be acquired, both from experiment and from the experience of other fields, and the district should soon become a steady producer.

During last winter Prof. Miller had the opportunity of visiting the well-known corundum districts in North Carolina and Georgia. Some of these deposits have been worked for a number of years, but at the time of his visit there was little activity in the industry. This was owing chiefly to two causes. The deposits are so situated that the product of the works has to be teamed long distances over mountain roads in order to reach shipping points on the railroad. Moreover, several of the deposits on which considerable work has been done have been found to be of small size and have been abandoned. Only one property has apparently been worked with success, and the easily worked material in this deposit is now about exhausted. Up to the present the product has come chiefly from the decomposed rock matter, but hereafter the output will have to be derived from treatment of the solid rock. A new plant with new method of treatment is necessary to ensure success and to overcome difficulties of transportation.

The Ontario deposits certainly have a considerable advantage over those of the South in respect to cost of transportation. In regard to the quality of the material so far produced from the deposits of this Province there is nothing to be desired. As to their size and the percentage of the mineral in the rock, Prof. Miller says they compare favourably with any deposits which he has examined. Indeed it is doubtful if any of the Southern deposits contain as much material which can be worked at a profit as do some of those of this Province.

The mineral occurs in the South under conditions similar to those under which it is found here, but the rocks in which it there occurs are on the whole considerably more basic.

At the present time it is almost impossible to obtain corundum on the market. There are many cases in which if it were obtainable it would replace emery entirely. In other cases it is in demand for mixing with emery in order to bring up the cutting power of the latter. The demand for high class abrasives is increasing, and is likely to be much greater in the near future.

POSTSCRIPT.

The Canada Corundum Company has been vigorously prosecuting development work of late and a small mill has been erected. The treatment of the corundum rock is still (August, 1900) in an experimental stage, and for that reason no detailed account of the operations is given. However, Mr. J. W. Wells, Assayer at the Provincial Assay Office, Belleville, recently paid a visit to the works and has prepared the following brief sketch of the plant.

The officers of the Company are,—President, Clark Edwards, Bridgeport, Conn; Vice-President, J. N. Shenstone, Toronto; Managing Director, B. A. C. Craig, Toronto; Mine Manager, R. T. Hodgson, B.A., graduate of Kingston School of Mines; Mill Foreman, L. S. Ropes, graduate of Houghton School of Mines, Michigan. There are at present thirty-five men on the pay roll.

The mines owned by the Company now being opened up are situated on the south slope of a hill on a farm owned by Henry Robillard, in the township of Raglan, Renfrew county. The exposure showing corundum in place runs 250 feet north and south, and is about 300 yards wide. Considerable stripping of overlying earth and debris has been done. There are three openings which are being worked by benches, starting from the lowest exposure as in a quarry. About 550 tons of milling rock were on the dumps at the time of visit. The corundum occurs in form massive to crystalline, from the size of a pea to 100-lb. lumps, in a reddish syenite. Hand cobbing is not necessary, as most of the rock taken out is fit for milling, carrying from fifteen to thirty per cent. corundum. The rock is hauled by teams to the mill, three-quarters of a mile distant.

The mill is located on the site of Kelly's saw mill, on a creek flowing into the York branch of the Madawaska river, about seven miles south of Combermere village by the road. The mill dam is fed by three streams and an upper dam, giving fairly good power. Application is being made to the Government to divert the waters of Echo lake, which would give abundance of power. The mill at present is only experimental, the object being to determine the cheapest and easiest method of concentrating the raw material to a marketable product. It treats on an average twelve tons of rock per day of ten hours, giving from one and three-quarters to two and a half tons of concentrates. Water is drawn from the dam by a penstock 15 inches in diameter, 442 feet long, leading to a five-nozzle Leffel Cascade impulse water-wheel, furnishing with a fifty-two foot head of water 35 available horse power. The water-wheel is connected by belting, shafts and wire cable to the main shaft in the mill, 400 feet distant from the wheel.

The rock broken to a convenient size is fed to a large Gates crusher, the crushed rock passing down to large steel rolls. The product from the rolls is elevated to a tilted revolving cylindrical sizer divided into three compartments, (1) $\frac{1}{8}$ inch, leading to concentrating tables below; (2) $\frac{1}{4}$ inch, leading to a two-compartment Hartz jig; (3) $\frac{1}{2}$ inch, leading to a two-compartment Hartz jig. The rejections from the sizer go down to the rolls for re-crushing. The concentrated production from the jigs, freed to a considerable extent from felspar, mica, etc., is re-crushed, washed, dried, freed from magnetite by a magnetic separator and sized by screens to marketable product, containing on the average 99.5 per cent. of corundum. The fines ($\frac{1}{8}$ inch and finer) from the sizer pass to two tables—a Wilfley and a Bartlett—which separate the corundum almost completely from felspar, mica, etc., the magnetite however being retained. The product from the tables is dried, passed through the magnetic separator to free it from magnetite and sized for the market. A Gates crusher is used for crushing concentrates for sizing, and for drying a patent dryer made by the Wm. Hamilton Manufacturing Company, Peterborough.

The marketable product, sized from 16 to 40 mesh to meet demands, has a first-rate abrasive quality, owing to the crushed corundum not breaking along parting planes, thereby having a hackly fracture and rough edges. The product sells at an average price of six cents per pound, with a greater demand than supply, as it is alleged to be superior in every respect to emery, carborundum or any other abrasive on the market used for the same purposes.

The Company has plans prepared for a 100-ton mill to be erected as soon as a satisfactory scheme of concentration is evolved from the experimental plant now in operation.

PEAT FUEL.

Whether coal existed in this Province or not was a question of intense interest to the inhabitants in the early decades of the present century. The growth of coal mining in the States lying immediately to the south aroused the attention of the farmer-settlers on British soil, and the fondest hopes were entertained that vast stores of the precious fuel would be discovered on this side of the line. A scheme for the scientific exploration of the Province gave rise to the Geological Survey, with a chief who had become famous for his work on a Welsh coal field, and for many years Logan and his faithful staff labored at a herculean task. As time went on, and data were accumulated, it became more and more evident that coal was not to be found in Ontario, although a variety of other minerals in greater or less profusion were discovered at many points.

With the exception of wood, which grows alike in scarcity and price year by year, Ontario must import her supplies of fuel, and only recently has any glimmer of a coming change been seen. Throughout the entire Province there are vast areas of vegetable matter in the first stage of its conversion into coal, and the utilization of this peat is one of the problems which is being vigorously attacked just now. In previous reports of the Bureau the occurrence and uses of peat have been described in detail, and during the past year satisfactory progress has been made towards the inception of a peat fuel industry.

TRENT VALLEY PEAT FUEL CO.

About one and a half miles south of Victoria Road, a station on the Cobocank branch of the Midland Railway, are situated the works of the Trent Valley Peat Fuel Co. For over a year the officers of the company have been experimenting with various forms of apparatus, and have evolved a plant for the conversion of the moist, spongy peat into dry compact briquettes whose calorific value per unit of cost compares favorably with coal.

Peat bogs in the basin of Balsam lake, stretching southeast from the works with an area of 30 square miles and southwest with a similar area, are to be the sources of supply, while large stores to the northeast are available also should the demand arise. The depth of the peat varies from 4 to 55 feet, and the computation of the quantity obtainable leads to enormous figures. The peat is dug out by a dredge handling three cubic yards or 4,050 lb. per minute, and is piled in heaps on the bank for air drying. After two weeks or so, the peat is removed by the dredge to barges which are towed to the works. At this stage water constitutes 80 to 90 per cent. of the whole, and this is lowered to 55 per cent. by a pressure of 300 tons applied to one ton lots of peat at a time. The compact block which results from this operation is thrown into a screw conveyor and broken up roughly in order that it may be handled by a chain conveyor. The latter forwards the peat to the breaker, which consists of a large number of loose arms mounted upon subsidiary axles, in such a manner that when the main shaft is revolved the arms upon the other axles fly out by centrifugal force and beat violently any objects within their reach; the whole is cased in. The peat is by this means reduced to fibres and powder, and passes to the dryer, which was built by F. D. Cummer & Son, Cleveland. This apparatus consists of a cylinder 30 feet in length, enclosed in a large brickwork chamber, and the following concise description is extracted from the manufacturer's catalogue: "The pure heated gases resulting from perfect combustion of the fuel in the heating grate pass into a large commingling chamber which extends the entire length of the dryer

cylinder. This cylinder (which is set at an incline and revolves slowly in trunnioned bearings) has a great many large hooded openings so arranged that the heated air and gases at highest temperature are drawn through the hoods by a fan into the cylinder in direct contact with the wet material entering the machine. The material immediately commences to part with its moisture, and as it travels rearwards towards the discharge constantly becoming more dry, the temperature of the heated air brought in contact with it is relatively lowered. The drying material is constantly being cascaded in the cylinder." After drying, the peat is conveyed to the compressing house, in which are installed three machines of Dickson's patent. This machine is fully described in the seventh report of the Bureau, page 22.

To make good briquettes the moisture must not exceed 12 per cent. ; if there be more than this, the briquettes crack on drying, and chip readily, while if ignited they burn with a series of small explosions due to the generation of steam. Nor must the moisture be less than 10 per cent, or the friction in the compressing tube becomes so great that the machines would soon be racked to pieces. However, by means of the hydraulic press and with careful attention to the temperature of the drying kiln, it is anticipated that there will be no trouble in the production of a fuel of uniform excellency.

From the machines the briquettes travel by a screw conveyor to the storehouse, where they are sacked and hauled to the railway or shipped in barges by the Trent Valley canal which passes by just beside the works. The company believe that when the works are running to their full capacity the briquettes may be delivered in Toronto at a price which will make them a dangerous competitor for other fuels in the market. With cheap water communication along the canal there is no apparent reason why the briquettes should not be delivered in the towns along the line at such a cost as to displace all other fuels save anthracite.

The officers of the Trent Valley Peat Fuel Co., are : President, A. L. Davis ; Secretary-Treasurer, W. G. Morrow ; Superintendent, W. J. Sims ; the head office is at Peterborough. To Mr. Sims, who is a contractor, chiefly for Government work, is due all the credit for the plant ; his ideas and experience are embodied in the present plant, and many changes have been made under his direction. The company have secured from the Canadian Peat Fuel Co. the rights to operate their machinery in the counties of Ontario, Durham, Victoria, Peterborough, Northumberland, Hastings and Prince Edward. The following buildings have been erected on the site previously mentioned : Drying kiln house 60 x 30 ft. ; storehouse for dry peat 100 x 40 ft. ; press house 30 x 40 ft. ; engine house 24 x 40 ft. ; storehouse for briquettes 60 x 30 ft., capacity 200 tons. Power is supplied by a 90 h. p. boiler and a 75 h. p. Wheelock engine, from Goldie and McCulloch.

BEAVERTON PEAT WORKS.

Mr. Alexander Dobson has for some time been operating a plant for the manufacture of peat fuel near Beaverton. The works are situated upon a bog with an area of 150 acres, about a mile and a half south of the town, and a considerable quantity of compressed peat has been produced.

The surface having been stripped, the peat is cut by an automatic digging machine, which is so much superior to manual labor that it merits description. A trench is first cut in the bog, and the machine is placed in position close to the edge ; a short, enclosed link belt carrying knives and scrapers hangs from the machine, and touches the bottom of the trench which is made 8 inches wider for a foot or so at one end. When motion is communicated to the belt, the knives and scrapers cut into and carry up the peat to a hopper, from which it is removed to the other side of the machine by a short chain conveyor. At the same time the supporting wheels of the machine, which are very broad, are driven at slow speed, and the machine moves continuously forward, supplying to the digging apparatus fresh surfaces from which to cut the peat. In this manner the machine moves along the edge of the trench, increasing the width of the latter 8 inches in passing, and by a series of journeys removes all the peat from the area exposed to a depth of $2\frac{1}{2}$ feet. When discharged from the machine the peat is raked out into thin beds and allowed to dry roughly ; it is then shovelled into waggons and drawn to the mill by electric power. The peat must now be more thoroughly dried, and this is done, after a preliminary breaking, in an apparatus which has been patented by Mr. Dobson. It con-

sists of a cylinder made of boiler plate, 5 feet in diameter and 30 feet long, mounted on an axle which dips a little from the horizontal; the cylinder is enclosed in brickwork with a fire-place under the higher end. The lower end is open, and connection is made with the chimney in such a way that when a fire is lighted in the grate the flames strike the outside of the cylinder, almost at its highest point, and play along it until the other end is reached, where the products of combustion pass into the cylinder, and after travelling back over the wet peat, which is fed in at the upper end, escape through the stack. The peat is subjected to two drying influences, the direct heat of the fire and the current of hot dry air which is escaping, so that only a short time is needed for desiccation. The dried material, still retaining 10 or 12 per cent. moisture, is passed through a Dickson breaking machine and then passes to a Dickson press. In a 10-hours day 5 tons of briquettes on an average are turned out by the one machine, and it is probable that some experiments which are being made will result in an increase of the production to 10 or 12 tons per day. Considerable difficulty is experienced with the dies, which often break under the strain, necessitating a costly delay in operations; it is almost certain, however, that this obstacle will be overcome shortly and the whole plant will be worked smoothly and continuously. The briquettes are delivered in Beaverton at \$3.25 per ton, in comparison with anthracite at \$6.25 per ton, and find ready sale. Those who use the peat consider that it is as good as coal, and prefer to use it because of the absence of smoke and clinker.

In a letter to the Canadian Peat Fuel Co., dated July 16th, 1900, Mr. Dobson makes the following statements:

"Answering your enquiries *re* output of my one machine plant, I can readily manufacture 2,000 lb of peat fuel per hour, using dies $2\frac{3}{4}$ in. diameter, (with chilled eccentrics now being furnished and heavier dies I anticipate no difficulty in operating continuously). To run my plant I employ eight men at a cost of \$9.30 per day of ten hours. This includes the cutting of peat by one man to fire the boiler and drier, (one man can cut in a single day enough crude peat for firing purposes to last several days.) *Re* cost of production: There is no question but that I can produce the fuel, provided the plant is operated continuously, under \$1.00 per ton. I would recommend operating night and day, and after improvements to press are completed I propose to keep my plant running day and night. The cost of production will thereby be appreciably reduced. *Re* Drier: Working upon peat carrying from 40 to 50 p.c. of moisture my drier easily delivers enough suitably dried peat for one press. Two cylinders can readily be operated in one furnace, delivering two tons of dried peat per hour. Cost of installation would be about \$1,700. The dryer is simple in construction, very durable and is easily operated by one man. *Re* Electrical Digger: A simple, strongly constructed plant costs less than \$500, digs enough peat in one day to supply one press three days. *Re* Sale: There is no difficulty in finding a ready market; even in this vicinity where wood is freely used I get \$3 per ton at works and my customers think highly of the fuel. My plant can be duplicated for \$8,000, and I am convinced that wherever a bog adjacent to a town is to be had a highly profitable return can be depended upon under proper business management."

Shortly after this letter was written Mr. Dobson was unfortunately burnt out, and it will be some time before the plant can be repaired and started afresh.

OTHER PEAT COMPANIES.

The following individuals or companies are also commencing to manufacture peat fuel, or have already done so:

The Simcoe Peat Fuel Co., Barrie, with one Dickson press and breaker and Dobson dryer. A peat bog about two miles from the town will be the source of supply.

The Brockville Peat Fuel Co., who are just about to start operations.

Mr. Hogg, at Galt, has already made 200 tons and has sold the entire output at \$4 per ton.

The Welland Peat Fuel Co. have made 200 tons this year and are re-commencing after a delay caused by an accident to the machinery.

Mr. Ardagh, at Stratford, has made 250 tons this year and sells the fuel in the town at \$4 per ton.

Mr. Matheson, at Perth, with one machine has made some fuel, but has recently formed a company which will take over the business.

A company has also been formed at Chatham and the plant is being installed.

The Prince Edward Peat Fuel Co., at Picton, have two Dickson machines, but have to wait until a dryer is installed before satisfactory progress can be made.

From these notes it will be evident that the peat fuel industry is rapidly taking root in Ontario, and before long we may expect to see the little round briquettes making their appearance beside the time-honored coal and wood. This subject is of so much importance that Inspector De Kalb is preparing a special report dealing with the industry, which will be issued by the Bureau as soon as it can be prepared.

MINING ACCIDENTS.

The past year has been notable, among other things, for the number of serious accidents which have taken place, and it is a matter of the deepest regret that the deaths of fourteen men and injuries to eleven must be reported. While two of the fatal accidents may more properly be ascribed to the operation of a railroad than to a mine, ten of the remaining twelve cases are most distinctly due to the dangerous nature of mining when precautions have not been taken and carelessness has not been checked. Five of the deaths and two of the injuries have been caused by explosives, and this feature has become so serious that a Manual of Explosives, describing their nature, proper use and the precautions which should be employed, has been drawn up under the direction of the Bureau by Inspector DeKalb for the use of those engaged in mining.

Another prolific source of accident has been the misuse or failure of hoisting apparatus; four men have been killed and five injured by mishaps of this nature. This has led to a revision of those sections of the Mines Act which deal with hoisting, and a set of stringent regulations has been drawn up which will certainly reduce the risk very much.

In one instance a man was killed by the rolling of a large piece of ore which had been pointed out to him several times as dangerous, and in this case the blame must be laid entirely on the victim himself. Such an accident might readily occur in almost any excavation above ground, and it can hardly be said that the working of a mine is responsible for such mishaps as this.

In another instance a man was so severely injured by the collapse of a derrick that he afterwards died; and this again can hardly be laid to the account of mining operations. The following are the particulars of the casualties:

AT THE CANADIAN COPPER COMPANY'S MINES.

Six casualties occurred at Copper Cliff during the year, and three of the victims died from the injuries they received.

The first accident of the year took place on the 7th of March, at the rock house of the McArthur No. 2 mine. The cars which convey the ore to the roast yard are placed beneath chutes in the rock house, and are moved by means of crow bars in order that the material may be distributed over the body of the car. Occasionally there is a jam in the chute, and it is necessary to mount the car and loosen the mass with a crowbar. On the 7th of March such a jam took place and one of the men, F. Dido, started to climb up on top of the car. Unfortunately, instead of mounting at the end, as is customary, he chose the side; and as the car was at that moment in motion he was caught between the posts of the rock house and the side of the car and severely crushed. He was taken to the Sudbury General Hospital, and at first it was thought that his injuries were not serious. On the 8th, however, it became apparent that this estimate of his condition was amiss, and becoming rapidly worse he died at 10.30 a.m. on the 10th.

The accident was so obviously due to the carelessness of the deceased that it was not considered necessary to hold an inquest. The danger to which a man is exposed while engaged in such work is certainly not greater than that which confronts the brakeman in railroad work, and the company can be entirely exonerated from blame.

On the 30th of March an accident happened to Peter Flemming, an employee of D. L. McKinnon, roastyard contractor for the Canadian Copper Co. The man was working on the almost perpendicular face of a bed of roasted ore at a short distance from

the ground, and had been endeavoring to dislodge a large mass. Before effecting this he came down and went to work beneath it at the bottom of the heap until the mass suddenly gave way, and rolling down, knocked him over and broke his leg. He was taken to the hospital and after a short time was able to be about again. No blast was fired which would loosen the ore, and the affair can only be regarded as one of those unfortunate occurrences due to carelessness.

On the 5th of April E. Pelletier, another employee of D. L. McKinnon, was injured at Copper Cliff by a blast. Pelletier was working on the roast heaps, and having three holes ready in his pile asked permission to fire one of them. This was granted, and the warning whistles were given by the blaster; Pelletier lit the fuse and went off for some distance. His working-mate testifies that he saw the victim go back to the hole and for unassigned reason shove a piece of wood into it. As he was doing this the explosion took place, and the hand which held the wood was badly torn and some of the bones fractured, but amputation was not considered necessary. This accident was evidently due entirely to the foolhardiness of the man himself.

On April 22nd James Davis was severely wounded while working on a derrick at the McArthur No. 1 mine. A derrick was being erected beside an open pit, and Davis was aloft on the structure when it collapsed, throwing him over the edge of the pit to a depth of 25 feet. He was picked up unconscious, and gradually sank until on the 28th of the same month he died. An inquest was held by Coroner McMurchy of North Bay, and the jury found "that the said James Davis came to his death by the falling of the derrick at McArthur No. 1 mine and then falling into the shaft of the said mine on April 22nd, 1899, said accident being caused by neglect of the Canadian Copper Company, through their foreman, Hugh Dickson, in not having derrick properly guyed, and also in not providing spirit level so that plumbing could be done at bottom of mast."

On the 6th of June a man named Isaac Domanski was knocked down and killed by a train on the property of the Canadian Copper Co. He was on his way from home to the Copper Cliff post office and was walking along the track. A train of ore cars manned by Contractor McKinnon's men overtook him, and the two brakemen made every effort to warn him of his danger; but he seemed to be perplexed and confused, and stepping in the wrong direction was knocked down and instantly killed. Notices were posted nearby forbidding persons from walking on the track in that vicinity. Coroner McMurchy of North Bay visited the scene of the accident, and after watching the operation of the cars did not consider it necessary to hold an inquest.

An employe of the Canadian Copper Co., Samuel Lafthi by name, was injured on the 29th of July while going up out of a shaft, which was being sunk. The victim was climbing a ladder at the time, and slipping on a rung fell to the bottom. One of his legs was broken in two places, and there was a fracture at the base of the skull which caused some anxiety. On the 5th of August the man was reported to be doing nicely, and no serious results had followed from the scalp wounds.

AT THE MILLER MINE.

At the Miller iron mine. Hastings, operated by L. Sherk, Son & Co., Hamilton, William Gordaneer was injured in the latter part of March by falling some 30 feet down a shaft. He was engaged in dumping the bucket at the time, and caught his mitten on the hook from which the bucket is hung. He was dragged over the mouth of the shaft, and fell to the bottom about 30 feet, fracturing his leg. The shaft, apparently, was not fenced at the time, and if a proper railing had been provided the accident would probably not have occurred. The use of a proper subsidiary landing hook together with a fencing about the shaft renders the operation of landing no more dangerous than any other carried on in the mine.

AT LOCATION NT 20.

A fatal accident occurred at N T 20, near Shoal lake in the New Klondike district, on March 28th, when James McMahon was killed by a premature blast. Inspector Bow was directed to visit the mine and hold an investigation; and the following evidence was taken by him under oath. The witnesses were William Blouquest and James White, miners who worked with the deceased, Joseph Talbot, who was running the hoist, and

Charles Wright, manager of the mine. The shaft had been sunk vertically to a depth of 80 feet, and William Blouquest, James White and the deceased were working in the bottom of the shaft, hand drilling, on the night of the 27th-28th of March. About 2:30 a.m. on the 28th three holes had been completed and the deceased, who was foreman of the work, ordered the other men to go up while he remained below to charge the holes. The two men were hoisted to the surface in the bucket, and the latter was sent down again for the drills, etc. When these had been brought up eight sticks of powder, sufficient for the three holes, were sent down together with caps and fuse. After fifteen or twenty minutes, ample time to permit of the charging of the holes, the battery wires were lowered, each of the two men who came up handling one wire. These were not connected with the battery in any way, which at this time was in its own box in the engine house; no one but the deceased ever handled the battery or removed it from the box mentioned. It was quite dark at the time and those on the surface could not see whether the charging of the holes had been completed or not, but sufficient time for connecting the wires had scarcely elapsed before one of the holes exploded. Just a moment before James White had shouted down asking if the wires were long enough, and the deceased answered what they thought was intended for "all right," the latter word being drowned by the report.

The unfortunate man was found dead, with his face badly bruised, the side of his head crushed evidently by flying rock, his legs broken and with other injuries which showed that, in all probability, he was stooping over the hole working at it when the blast went off. The manager stated that none of the powder on the property was over a month old, and the evidence of the other witnesses pointed to the conclusion that it was in proper condition. It was kept beyond the reach of water in the storehouse, and hence could not have got wet; no premature blast or accidental explosion had ever occurred before on the property. The eight sticks used in charging the holes had been thawed out in the engine room before being sent down. The evidence of the two witnesses who had ever done any charging in the shaft, or had ever seen it done, was to the effect that the manager had cautioned them against the use of iron or steel, and only wooden tamping rods had ever been used.

At the time of the accident only two articles were in the shaft which could have been used for tamping; these were a wooden tamping rod and a small pump. The latter consisted of an iron pipe about 3 feet long and 1 in. in diameter provided with a piston inside, and was used for cleaning out holes previous to charging. When the pump was examined after the accident it was found that the lower end was slightly bruised and also slightly bent. This led the manager to the belief that the deceased had used it for tamping, and that it had been shot out by the blast. The Inspector, however, and with him another witness, was of the opinion that the bruising was simply due to ordinary wear and tear. Of the tamping rod only the upper half could be found, indicating in all probability that the stick had been in the hole at the time of the explosion and the lower half had been blown away.

The manager's explanation is that the deceased was probably inserting a stick at a time, and on account of irregularities in the hole had to use some instrument as a rammer. The pressure would probably squeeze some of the nitroglycerine from the absorbent, and if the pump had been used a spark might readily have been produced which would do the mischief.

The Inspector reports that although it was impossible to arrive at a satisfactory conclusion as to the exact cause of the premature blast, the evidence went to show that it was undoubtedly the fault of the victim, probably through carelessness in charging the hole.

AT LOCATION SV 129.

One of the most serious accidents in the year took place on the 18th of May, on the location SV 129 in the Manitou district. Three men, the night shift in this case, were killed instantly by the explosion of a hole which was supposed to have been fired. Inspector Bow, who was then at Bonheur, was instructed by wire to proceed to the scene of the disaster and make an investigation under oath. This was done, and a full report was forwarded to the Bureau.

Five witnesses were examined, Thomas Armstrong, James Maxwell, Samuel Morrey, William Quirk and William James Spedding.

The property consists of location 129 SV belonging to the Oxford Mining Co., head office, 80 Bay St., Toronto, and at the time of the accident a shaft had been sunk to a depth of about 40 feet. Work was being carried on day and night, with three men in each shift; the drilling was being done by hand.

The details of the accident are as follows: On Wednesday, the 17th of May, the day shift consisting of William Quirk, Samuel Morrey and William J. Spedding had drilled five holes to an average depth of 3 feet; these were being put in for the purpose of squaring up the shaft. At the end of the day Spedding and Morrey went up to the surface removing all tools, etc., while Quirk remained below to prepare for blasting. The five holes were charged with 60 per cent. powder and tamped with a little clay after the insertion of the fuses; the latter were of such length that the holes would be fired in succession. Quirk then came up and the three miners remained close by until they heard the blasts. There were only two reports, indicating that three holes had missed, so Quirk went below again and found that the fuses had not burned properly. He then took out the caps and fuses and inserted an "exploder" in one hole, together with a little extra dynamite, and coming up fired the hole with the battery. Again he went down, and this time arranged that the two remaining holes should be exploded simultaneously. One of these, however, was near the hanging wall, and the water running down was carrying a certain amount of sand into the hole on top of the powder and tamping; part of the latter was removed, but not all. Quirk was a little doubtful as to this hole, but came up and fired the holes with the battery. A report was heard and the men went off to dinner without waiting to ascertain whether both charges had been exploded or not, but believing that the former was the case.

The night shift, consisting of Cornelius Quirk, Joseph Laurin and Bud Irish, went up to work as usual, accompanied by the manager, Thomas Armstrong, who was going to help as was his custom in cleaning out the broken rock. William Quirk went up to the shaft again to see whether all the holes had broken, and calling to his brother Cornelius, who was below, he asked if the corner hole (pointing to it) had broken. Cornelius answered "Not very well," and William then warned him to be careful since some powder still remained in it. Armstrong, the manager, who was there also, told Cornelius Quirk that if he had any doubt about the hole to leave it until morning, and then when charging the other holes to insert a small extra charge and fire it with the rest. Armstrong and William Quirk then went down to the camp leaving no one but the three miners at the shaft, the blacksmith working by day only. At midnight the night shift were down to the camp for supper as usual, and the manager spoke to Cornelius Quirk; this was the last time any of them were seen alive.

In the morning the men went up to work at the usual time about 7 o'clock, the blacksmith being about five minutes ahead of the others. When he reached the shaft he found the lighted lantern hanging on the crank of the windlass, and pulling away the canvas covering which was used to keep out rain, he looked down and saw the men lying in the bottom. He ran back calling for help and met the others on their way up. James Price and Samuel Morrey went down at once and put the bodies into the bucket. The three men were perfectly dead, and must have been killed instantly. A drill 30 in. long was found stuck firmly point first in the collar of the shaft, with a piece broken from the head; it had probably been used for the drilling and had been blown against the side of the shaft which it struck with a force sufficient to cause a break, and then glancing off entered the wooden collar. On one of the bodies was a broken watch which had stopped at 2.57 a.m. The night shift blast from about 5.30 to 6 a.m. and their shots are always heard at the camp, but no report had been noticed by anyone during the night. There can be little doubt that the accident took place at the time indicated by the watch. All the drills and tools were still in the shaft, and it was very unlikely that before these had been removed any powder and fuse would be taken down; as a matter of fact none was to be found.

The positions of the bodies and the wounds that they bore pointed to only one conclusion. The three were drilling either so close to the missed hole that they unexpectedly broke into it, or their hole was so near to the dynamite that the blows were sufficient to cause an explosion. According to the evidence previously stated the men had sufficient

warning about the unexploded charge, and if cautious would probably have avoided it, although they might have thought that all the charges had gone off completely and for that reason taken the risk.

As no one living was down the shaft from the time of the firing of the day shift holes until after the accident, there is no possible way of obtaining evidence as to whether the night shift had reason to believe that any powder remained in any of the holes or not; the victims were good miners, two of them having had a number of years experience, and they should have been fully aware of any risks that they ran.

From the evidence it is clear that the men were carefully warned and that the responsibility rested upon themselves alone. It is often an easy matter to point out how an accident might have been prevented after it has occurred, and in this case two courses might have been taken. Had the last two holes been fired separately, if that were not disadvantageous under the circumstances, it would have been noticed that one of the holes had missed again and proper precautions could have been taken. Or if Wm. Quirk had gone down again after the blast had taken place, he would have discovered that the entire charge in one hole had not exploded. It is evident that when a number of holes are fired simultaneously there should be an inspection afterwards by some competent person.

An accident which bears a strong resemblance to the one described above is mentioned by A. H. Stokes, H. M. Inspector of Mines for the Midland District, Eng., in his report for 1899; the description is quoted in full. "A stone heading was being driven, and a shot of 5 cz. of bellite had missed fire. After an interval of 25 hours, the workmen commenced to bore another hole about nine inches from the missed shot. They were using a machine and screw-auger drill, and when it had bored about three feet the mis-fire shot exploded and injured two men. Upon examination of the stone after the accident it was clearly seen how the accident occurred; for instead of the second hole being drilled parallel to the hole of the missed shot, it was driven at an angle pointing towards the explosive in the missed-fire cartridge, and the screw of the drill had struck the cartridge at a point where the detonator lay, and thus fired the shot. This accident shows not only the importance of starting a shot hole as far as possible from a missed shot, but that its direction should be carefully noted, and be at a point increasing the distance between them rather than approaching the explosive at the back of the first shot-hole."

A slight accident occurred in the early part of June at the same location. James Price was overcome by gas, and while being hoisted in the bucket became unconscious and fell out. He was bruised and received a scalp wound, but his injuries were not serious and he quickly recovered.

AT THE REGINA MINE.

On the 1st of June a miner, Harry Lampshire by name, was killed by falling thirty-five feet down the shaft of the Regina mine. Inspector Bow visited the mine shortly after the accident, but on inquiring into the circumstances did not consider it necessary to hold an investigation. The shaft was being sunk by day and night shifts, and at the time of the accident only two men were at work in the mine, Henry Lampshire and Fred. Harris. It was between three and four p.m., and the men had hoisted the tools from the bottom of the shaft to the platform of the seventh level, thirty-five feet above. Lampshire was at the hoisting compartment at the seventh level and was lowering a rope to Harris at the bottom, when suddenly he fell and was instantly killed. Harris had no idea as to what made Lampshire fall, and there was no one else in the mine at the time. The platform at the level in question consisted of heavy six-inch timbers spiked down with an opening for the hoisting compartment. On top of this heavy round timbers had been piled, and these were held by struts to prevent the platform from being blown away. Consequently the footing was not very good, but such a condition is almost unavoidable where the platform is not far above the blast. The deceased was probably careless in moving about, and tripped or fell over some obstacle.

AT THE BLACK STURGEON MINE.

On June 19th three men, Charles Adams, John Howe and Charles Hass, were killed at the Black Sturgeon mine near Rat Portage through the failure of the hoisting apparatus

About five or ten minutes past seven p.m. four miners got into the bucket to be lowered to the bottom of the shaft. The engineer was standing some twelve feet away from the hoist at the time, and turned around when the signal to lower was given to find that the cable was paying out very fast instead of remaining quiet. He quickly put on the brake as powerfully as possible, and stopped the bucket when it had reached a depth of 120 feet. The shaft is vertical for the first sixty or seventy feet, inclined for the next forty or fifty feet, and then vertical to the bottom at a depth of 175 feet. The bucket in descending so rapidly struck the skids with considerable force and was dashed against the hanging wall, throwing the men off the bucket. Three fell to the bottom of the shaft but the fourth, Anderson, struck the skids, and slipping down them for some distance fell into the bucket again and was saved.

Inspector Bow visited the mine on the 22nd and 23rd of June, and made an investigation under oath into the circumstances of the accident. The following witnesses were examined: Patrick Culligan, manager of the mine and part owner of the property; George Robert Thurber, foreman of the mine; Edward Lindall, head engineer; James McMullen, second engineer; John Linton, lander; Charles John Anderson, who was hurt in the accident, and Oliver Longchamps and Alex. Phillips, miners on day shift at the time. The mine was at the same time examined and the machinery tested. The mine is situated on lot 11, concession 6, of the township of Haycock, and is owned and operated by Messrs. P. Culligan and F. W. Gilchrist. A shaft 6x11 feet had been sunk to a depth of 175 feet, and deviates from the vertical for from forty to fifty feet as has been already described. A ladderway with platforms constructed according to the Mines Act had been provided as far as the first level, which was at a depth of ninety-three feet, and below this ladders were suspended to within twenty feet or thereabouts of the bottom. The lower ladderway was not provided with platforms, nor were the ladders set at suitable angles, but it is not customary or convenient to have this arrangement for the first fifty or sixty feet from the bottom or below the lowest level because of the destructive effects of the blasting. According to the evidence in this case the lower ladders had not been replaced as they should have been, and it was necessary to use the bucket to reach the bottom of the shaft. A pole skidway was provided for the bucket in the inclined portion of the shaft.

The hoisting machinery consisted of a 7x10 in. duplex Ledgerwood hoist with driving pinion, friction clutch and band brake, a 7-8 in. steel wire cable and a steel bucket of half a ton capacity; the engine house was situated about fifty feet from the shaft. Ten men were employed in the shaft, five on each shift, working by contract. No orders to the contrary having been given, the men were always in the habit of riding in the bucket, and as many as three or four sometimes went down at once.

On the day of the accident, about 7.05 or 7.10 p.m., three miners of the night shift were standing on the edge of the bucket holding the rope and waiting to be lowered to the bottom. The bucket was hanging in the open mouth of the shaft, the top level with the floor. Charles Anderson, a fourth miner, told the lander to ring four bells, which was the signal for the engineer to lower men. The bell was rung, but how many times is uncertain from the evidence. Anderson was just stepping on the bucket when it started to descend with the four men on board, slowly at first, and suddenly with great speed. It was evident to those above that the bucket had run away, but it could not be stopped until it had reached a depth of 120 or 130 feet. George Thurber went down by ladder and found the bucket on the skids with Anderson in it still conscious, while the other three men were discovered at the bottom of the shaft dead. They had evidently been thrown from their positions when the bucket struck the skidway, and Anderson escaped almost miraculously in the manner described.

During this time the following incidents had occurred in the hoist house. The engineer, James McMullen, who had just gone on duty half an hour before, was the only one in the engine room at the time. He was standing at the door facing the shaft house and about 12 ft. from the hoist, when he heard the signal bell. Turning immediately, he saw that the drum was revolving, and knowing that something was wrong stopped it as quickly as possible by pressing his foot on the brake, applying in all probability at the same time the friction clutch. The brake lever had a play of about 6 in. between two uprights fastened to the floor; these were provided with nine holes each in which a pin could be inserted, so that if the brake were applied and it was desired to keep it in that

condition, the pin could be run through the hole above to lock it down. The Inspector found that the only hole that could be used was the sixth; those above left the brake too slack, while the others below could not be reached. He also ascertained that with the pin in sixth hole the brake alone would not even hold an empty bucket. This improper state of affairs had existed previous to and at the time of the occurrence of the accident. The brake should have been tightened by the adjusting screw so that when the lever was secured in place by the pin it would without the aid of the friction clutch have held the bucket loaded to full capacity. Had such been the case the accident would probably not have occurred. The Inspector also found that with the brake lever fastened at the sixth hole and the friction clutch applied tightly, the bucket could be held when full of rock with six men standing on the rim. The day engineer, when he went off duty at 6.20 p. m. on the day of the accident, left the brake lever with the pin in the sixth hole and the friction clutch on as was customary. This should have withstood much more than the strain to which it had been subjected as shown by the result of the experiment just quoted. The night engineer however, although he did not touch the brake lever, ran the engine for a short time when he came on duty to clear the water out of the cylinders, and to do this without moving the drum it was necessary to throw off the friction clutch. While doing this he would be compelled to press his foot on the brake in order to hold the bucket.

It was also found that when the brake was off altogether and friction clutch applied and held tightly, a certain weight in the bucket would reverse the engine, as would naturally be expected; but if the clutch lever were not held in position by the engineer the revolution of the drum would throw it upwards in such a way as to release the friction clutch, leaving the drum free to run away. When the clutch lever was applied tightly it was almost horizontal in position, and it was discovered that if the lever were raised through 30 or 40 degrees and the brake was applied the drum could not be held but would gradually gather speed.

The probable cause of the accident may now be explained as follows: The night engineer, when he came on, released the friction clutch and ran the engine for a short time as has been previously stated. When re-applying the friction he probably did not shove the lever down until it was horizontal, but left it at an angle of from 20 to 30 degrees from where it should have been. The brake as has been stated was left on by the day engineer, and had not been touched at all. Under these circumstances, from the last experiment made by the Inspector, it would appear that three men could be held, but when a fourth got on the drum was started with considerable resistance at first until the clutch was thrown off, and it was then free to run away restrained only by the feeble brake. The blame for the accident could hardly be placed upon any one man. The manager should not have allowed riding in the bucket, and the men should have used the ladderway to the first level at least. The foreman should have seen that the bottom ladders were replaced after blasting so that recourse to the bucket should not have been necessary. The head engineer should have seen to the proper adjustment of the brake, especially as men were being raised and lowered.

AT THE GOLDEN STAR MINE.

During the year four accidents occurred at this mine, one of which resulted fatally. On August 17th a machine runner, James McAuley, was struck by a piece of falling rock while engaged in sinking the shaft. The victim was working in the sump when a small piece of rock fell from the manhole at the level above, and struck him in the head, inflicting a scalp wound fortunately not serious and a severe cut on the hand, at the same time breaking a finger. On the 19th of September he was reported as quite recovered from his injuries. An accident such as this can only be avoided by caution on the part of workmen themselves, and due care that their actions shall not endanger others. Those who were working at the platform above by accident kicked a piece of rock down the manhole of the ladderway, and probably would never have noticed it had their attention not been called.

On Dec. 8th a timberman, Albert Green, was injured while working in the shaft. He was engaged in erecting a ladder with the purpose of cutting a hitch for the reception of timber about 12 ft. above the sixth level, when he lost his balance and fell 30 feet to the bottom of the shaft, sustaining a severe scalp wound and bruises about the left

shoulder and arm. Fortunately his fall was broken by the skids which lie here at an angle of 70 degrees, so that he slid for the first 20 ft. instead of falling the entire distance. On the fourth of January the manager reported that he had entirely recovered.

On Dec. 11th a machine helper named William Mitchell, while erecting a drill on a stoping bar, accidentally fell a distance of 4 ft. and broke his leg halfway between the knee and the ankle. On Jan. 4th, 1900, he was reported to be doing nicely, and it was expected that he would shortly be about on crutches.

On the 22nd of December R. L. Burnet lost his life in the third level north. The deceased was engaged in shovelling rock into a chute by which the broken ore was discharged into cars on the level below. While thus occupied he undermined a large piece of quartz which was partly embedded in the loose stuff, intending to jump aside when it rolled down. Charles Kellog, who was working with him, spoke several times of the danger of taking too much from beneath the mass, but Burnet paid no attention. Finally the rock broke loose and although Kellog saw it coming and shouted to Burnet, the latter had not time to escape and was instantly killed.

AT THE CAMERON MINE.

By the explosion of some dynamite one man was killed and another severely wounded at the Cameron mine, North Hastings. This mine belongs to the Colonial Copper Co., 32 Broadway New York, and lies about 16 miles northwest from Coe Hill. Inspector De Kalb was instructed to visit the ground and investigate; he reported the following details of the affair: On the 21st of Oct. about 4 p. m. Peter Weese, a miner, and William Galbraith, foreman, were thawing dynamite at the fire in the forge of the blacksmith shop. Mr. Galbraith testified that he and Peter Weese had each a cartridge warming them near the blaze of the fire, while five cartridges were laid to one side in the blacksmith shop. Mr. Galbraith observed that the cartridges were not thawing properly, and had just said to Weese that they had better stop and "put them in the hole," when the explosion occurred. Mr. Galbraith believed that his cartridge had exploded first.

Mr. Galbraith is a native of St. Celestin near Three Rivers, Quebec, but is now a resident of Chalmers, Mass. He is 52 years of age and has been engaged in mining ever since he was 14 years old. He stated that he was quite familiar with hot water thawers, but had been deterred from procuring one for two reasons. In the first place, he had received stringent orders to reduce all expenses as much as possible, although he still had liberty to purchase anything which was urgently required. In addition to this he was expecting that work would cease very shortly, and on that account he was loathe to add to the equipment. It was only during the last two or three weeks that there had been any trouble with the powder, and previous to that he had thawed it simply by the heat of the sun. He had no idea that it was dangerous to thaw dynamite before a fire, and had never had a man injured before while working for him. He had always tried to be as careful as possible of his men and himself in so far as his knowledge extended.

William Daniels was just leaving the blacksmith shop at the time of the accident, and was the only other witness of the affair. His account corroborates that of Mr. Galbraith in all essential details. He states that Peter Weese held two cartridges instead of one, and that he saw the wrapper on the one Mr. Galbraith held take fire. It then went out and he admonished the men to be more careful. Then he saw it take fire again and started to leave the shop. Just as he reached the door the explosion took place and he was hurled 25 ft, but suffered no serious injury. Weese, who was instantly killed, was horribly mutilated, while Mr. Galbraith had one eye blown out, the other blinded, and his hands were so severely lacerated that they had to be amputated.

The saddest feature about this unfortunate occurrence is that it was due entirely to the ignorance of the foreman, who should certainly after the experience of so many years have known better than to thaw dynamite before an open fire. The opportunities which he must have had for learning the danger of this procedure were undoubtedly numerous, and it is almost incredible that he had not some idea of the risk incurred.

AT THE MIKADO MINE.

On Nov. 3rd Oscar Anderson, a miner, was injured while riding in the cage at the Mikado mine. Inspector Bow paid a visit to the mine and reported the following details of the accident.

It occurred in the main shaft, which is vertical and 250 ft. deep. Timber sets are provided at intervals of 6 or 7 ft. and a cage is used for hoisting. At 11.30 a. m., on the day of the disaster, drills were being sent to the surface in the cage. The shorter ones were lying across the floor, the length of some of them being but very little less than the width of the cage, while the longer ones were standing on end and leaning against the side of the cage. Four miners, one of whom was Anderson, were riding up at the time, one standing in each corner of the cage. There was but very little space, sometimes less than an inch, between the cage and the wail plates, and while passing the 120 ft. level Anderson turned to look at a man who was standing there with a light, and it is supposed by this movement shifted one of the short drills on which he was standing until it projected far enough from the floor of the cage to catch in the timber. The drill was tilted up, and Anderson's feet were thrown off the cage, while at the same time one of the longer drills was hurled forward against him, forcing him out of the cage, which was not provided with a guard railing. Before the cage could be stopped the victim was caught between the cage and the next wall plate, and he was badly squeezed. He was sent at the request of his relatives to the hospital at Port Arthur, where he died after a month's illness. The cage was not provided with the required safety appliances, and was hence unsuitable for raising or lowering men, but there was a notice posted at the shaft mouth forbidding riding in the cage, and instructions to the same effect were left in the Inspector's Book previous to the accident. It was however the almost universal practice for the men to disregard these orders when the manager was not in the vicinity, but since the accident the men have been more careful.

In view of the fact that the men had been forbidden to use the cage, and were only in the habit of riding up and down during the absence of the manager, it is evident that the blame falls upon the men themselves, and that the authorities had done all in their power to prevent accidents.

AT THE VANKOUGHNET MINE.

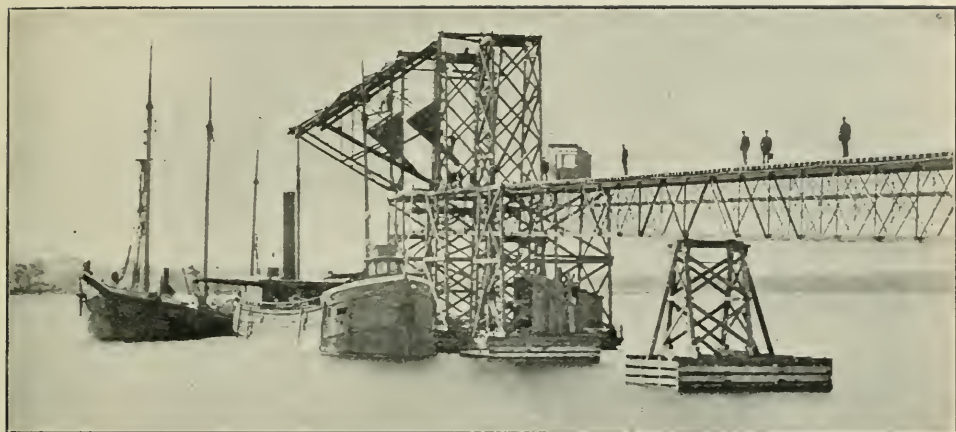
On the 8th of November an accident occurred on lot 14, con. 9 Foley, known as the Vankoughnet copper mine; the property belonged to a company known as the Niagara and Georgian Bay Mining and Development Co. Ltd., which had only been provisionally organized and was not yet incorporated. A contract for the work was let to a man named Jacobs, who had full charge of the work. On the date mentioned one of the men, Hugh Vankoughnet, was being hoisted in the bucket and had nearly reached the surface, when in some unexplained manner the bucket upset and Vankoughnet fell some 37 ft. to the bottom of the shaft. Three ribs were broken, the skull was injured, the hip fractured and there were other injuries, so that the unfortunate man lay unconscious for two days.

AT THE WILCOX MINE.

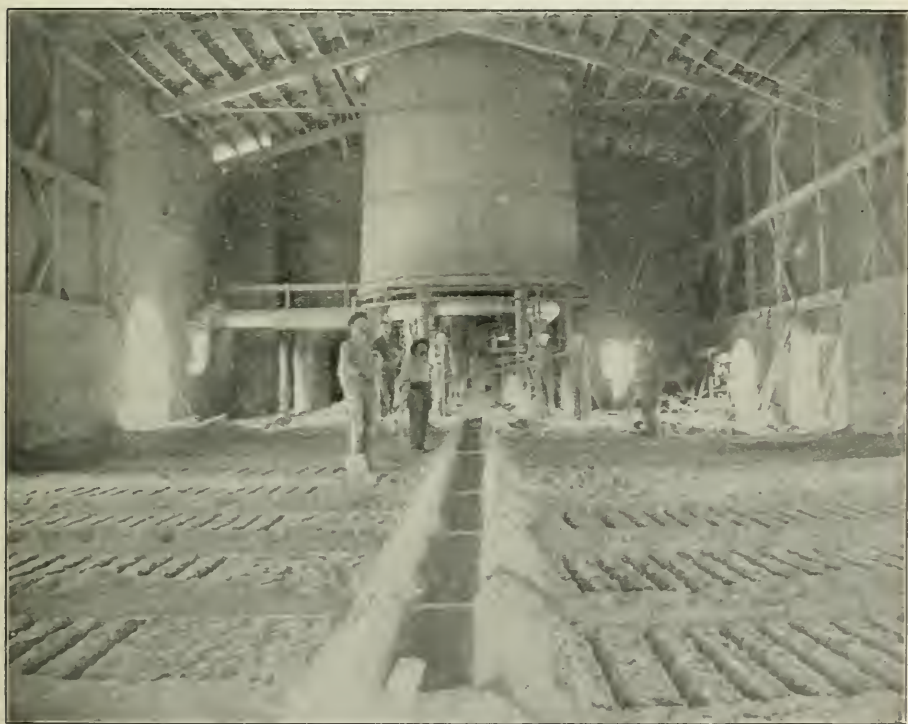
On November 16th two men were injured at the Wilcox mine, belonging to the Parry Sound Copper Mining Co., Ltd., by an accident to the hoist.

The day shift were going off and the night shift were starting when the mishap occurred. The two men, Robert Adair and M. McMichael, had just stepped on to the bucket to go below, and had been lowered about 20 ft. when the nut on the bolt which fastened the hand brake to the frame came off and the bolt dropped out. This of course rendered the brake entirely useless, and the operator threw the hoist into gear to try to break the fall. It was impossible to do much however, and the men fell 40 ft. to the bottom of the shaft. The company's physician was in attendance as soon as possible, and it was found that Adair had his right knee injured and a bruise on his head, while McMichael had a severe sprain in the right leg and was thought to have been injured internally. Both men however recovered entirely after a short time.

Inspector DeKalb, commenting on the accident, stated that it appeared to be due to the cheap construction of the hoist in having only one brake, while no machine used for the raising and lowering of men should have less than two. He remarked that it was also objectionable to raise or lower men in buckets except where a crosshead was employed as a guide, and since this was inconvenient for the men they were practically forced to use the ladderway. In all cases a manway should be provided unless the hoist has been inspected with reference to safety in raising and lowering men, the men should



5. Unloading Pier of Blast Furnace at Deseronto, pp. 15, 102.



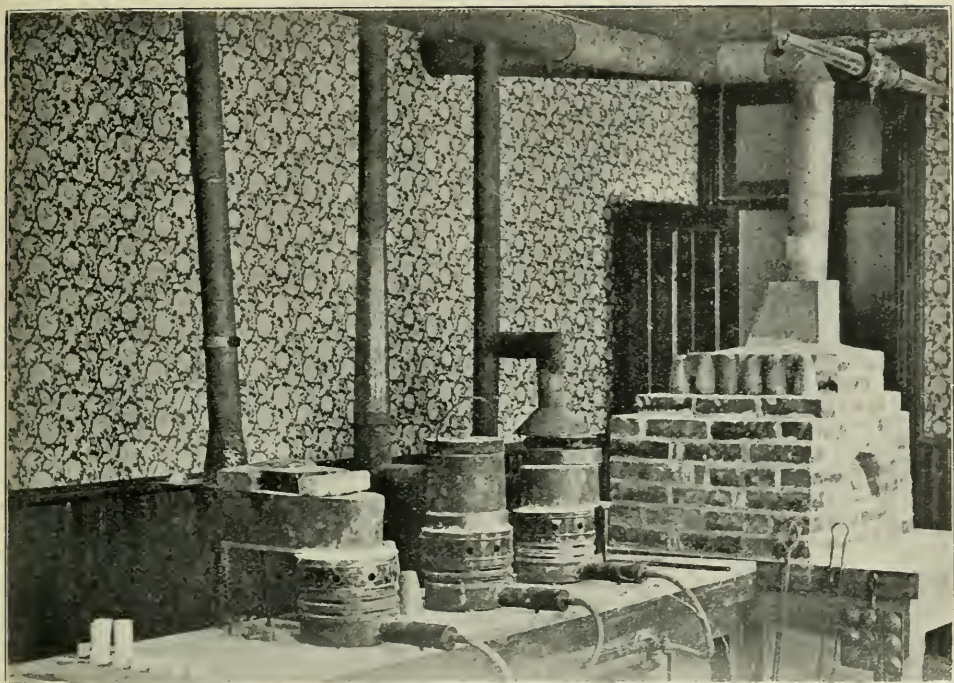
6. Cast House of Deseronto Blast Furnace, pp. 15, 102



7. Laboratory of Deseronto Blast Furnace, p. 33.



8. Provincial Assay Office, Belleville, p. 33.



9. Furnaces in Provincial Assay Office, Belleville, p. 33.



10. Analytical Room of Provincial Assay Office, Belleville, p. 33.



11. The Sultana Gold Mill, p. 38.



12. Burley Gold Mine in Lake of the Woods, p. 42.

be required to use the ladders. Another objection to the use of buckets for hoisting and lowering men is that a hood cannot be provided as is done on a cage to shield men from articles falling from above. These provisions with some others have been embodied in the Mines Act.

THE PROVINCIAL ASSAY OFFICE.

The Provincial Assay Office, at Belleville changed its quarters during the year and now occupies two flats and six rooms on No. 24 Victoria avenue. The first flat is used for an office, for sample room and for store room. The office contains five excellent cabinets holding collections of economic minerals and rock specimens, comprising in all about three hundred which are available for reference. The sample room contains pulped samples for reference and a collection of rough samples from all of the developed properties in eastern Ontario. The store room contains chemical supplies for the practical work of the office. The second flat is divided into a balance room; an analytical room, with three fume chambers, work tables, volumetric stock solutions and laboratory apparatus; a furnace room, containing one large Hoskins muffle gasoline furnace, one set of Brown gas furnaces, work tables, etc.; and a crushing room, containing rock crusher, Wetherhead pulverizer, mortars, sampling tables, etc.

The laboratory work consists of (1) assays or determinations of values of gold, silver, copper, nickel, lead, zinc and platinum; (2) analytical quantitative determinations of metallic iron, sulphur, phosphorus, titanium dioxide, silica, magnesia, etc.; (3) qualitative determinations; and (4) identification, by the determination of the names or characters of mineral specimens, with constituents so far as can be ascertained by qualitative wet and dry tests.

The laboratory equipment allows for gold and silver assays by fire method, arrastra amalgamation and cyanide leaching, and samples can be treated up to 25 lb. in weight. For copper both the electrolytic and cyanide methods are used, and for nickel the electrolytic and the Merry cyanide methods. Lead is treated by fire assay and by the molybdate method for finer determinations, and zinc by the ferro-cyanide volumetric method. Analytical determinations are made by the best known methods in actual practice, both volumetric and gravimetric.

The samples coming from the various parts of Ontario differ in character and require special attention, so that all determinations are made in duplicate when possible with a view to reducing errors to a minimum. The laboratory undertook check or control work during the latter part of the year, and samples sent in for check results are done in duplicate always, sometimes in triplicate.

Samples received for assay or analysis of less than three pounds in weight are pulped in toto to 100-mesh fineness. A larger quantity is broken to 5-mesh and sampled down by the usual methods, when a portion is taken and pulped to 100-mesh. All determinations except those requiring impalpable powdering in an agate mortar are made on samples of 100-mesh.

The assay bead balance in use for weighing gold residues and silver beads is sensitive to the $\frac{1}{1000}$ th of a milligram, giving gold values to twenty cents per ton of ore. The short-beam analytical balance reads to $\frac{1}{100}$ th of a milligram. These balances answer very well for ordinary work.

The following table gives a record of the work done at the Office during the year :

Assays :	For B. of M.	For the Public.	Total.
Gold	197	672	869
Silver	18	136	154
Nickel	6	50	56
Copper	10	162	172
Cobalt .....	..	1	1
Lead	3	3	6
Zinc	6	3	9

Analytical Determinations:	For B. of M.	For the Public.	Total.
Metallic Iron	15	48	63
Silica	14	27	41
Phosphorus	10	22	32
Titanium dioxide.....	11	23	34
Sulphur	17	33	50
Arsenic .....	..	9	9
Lime	4	15	19
Magnesia	4	3	7
Alumina	4	3	7
Ferrous Oxide	4	4	8
Ferric Oxide	4	5	9
Soda	4	3	7
Potassa	4	3	7
Moisture.....	8	5	13
Carbon dioxide.....	5	..	5
Sulphuric acid	5	..	5
Chlorine	5	..	5
Platinum	1	5	6
Manganese.....	1	1	2
Carbon	10	3	13
Ash	10	3	13
Volatile combustible.....	10	3	13
Organic matter.....	3	3	6
Totals	393	1,248	1,641

There were received 304 samples for identification, or qualitative examination more or less complete, of which 224 were reported on free of charge. This class of laboratory work is probably of as much value to prospectors as an actual assay or analysis, and therefore it was determined during the year to charge a nominal fee for the work. The following table gives the fees collected at the Office for each month of the year.

Months.	Assays and Analyses.	Identi- fication.	Total.
January	\$40.80	.. ..	\$40.80
February	35.10	.. ..	35.10
March	28.20	.. ..	28.20
April	35.45	.. ..	35.45
May.....	60.35	.. ..	60.35
June	117.05	.. ..	117.05
July.....	101.10	.. ..	101.10
August.....	130.65	.. ..	130.65
September	161.55	\$10.00	171.55
October	152.75	5.00	157.75
November	161.90	5.50	167.40
December	120.10	12.60	132.70
Totals	\$1,145.00	\$33.10	\$1,178.10

In addition to the foregoing are fees collected at the Bureau of Mines on samples sent through that office. No certificate of assay or determination is issued until the fees are paid.

MINES OF NORTHWESTERN ONTARIO.

By James A. Bow, Inspector.

I have the honor to submit herewith my annual report on the mines of western Ontario for the year 1899.

My duties during the year have varied somewhat from the usual course. The former part of the summer was taken up in collecting specimens from the various mines for the Paris Exhibition of 1900, and incidentally in making a brief inspection of the mines visited while doing this work. During part of July and August the time was spent in making a special examination of the Golden Star mine, and at the same time all the other mines in the Lower Seine locality were visited. Since then a general tour of inspection was made over the district, in which all the principal mines and most of the locations on which work was in progress were visited. Since so much of my time was taken up in collecting for the exhibition, and especially because this work was required to be done as soon as possible, I was not able to visit every location which was being worked, although all the important places were inspected.

Very satisfactory progress has been made over the district as a whole, some localities having been of course much more active than others. There are altogether about 120 locations or properties which have been worked during the year, but on an average not more than about 50 or 60 have been in operation at a time, and only about 20 have been in actual operation the year round. It is very difficult to give accurate figures in these matters, since many of the properties are only worked intermittently, generally for a few months at a time. In order to pay a visit to every location at which mining work was being carried on it would have been necessary to travel continually during the whole year.

There are twenty gold mines altogether that have stamp mills, a few of these being only two stamp test mills. Eighteen different mills have produced gold during the year. There is a total of 331 stamps in the district. Of these, 251 are installed and either in use or ready for use. Of the remainder, 37 are in process of installation, 23 have not been in operation for years, and probably never will be again, and one mill of ten stamps has been burned down. Of the 251 stamps installed and in use, 225 are gravity stamps, and the remaining 28 are Tremaine steam stamps. Of the gravity stamps, 241 belong to gold mills and 10 to silver. Of the Tremaine stamps, 26 belong to gold mills and two to silver. Ninety-seven gravity stamps, besides several Tremaine mills, have been or are being installed since last report.

It is impossible to give accurate statistics regarding the number of men employed in mining in the district, but approximately there are about 1100; of whom about 50 per cent. or 550 are miners. About half the total number, or 550, are employed at the producing mines when they are all in operation, and of these about 225 are miners. Of course these figures constantly vary throughout the year.

The depths of the principal mines are as follows, the date representing either the time of my last inspection or the date of my latest information: Sultana, 530 feet, March, 1900; Golden Star, 480 feet, Jan., 1900; Regina, 475 feet, November, 1899; Foley, 420 feet, May, 1898; Mikado, 300 feet, March, 1900; Olive, 251 feet, Jan., 1900; Triumph, 226 feet, 1898; Decca, 210 feet, Oct., 1899; Triggs, 210 feet, March, 1900; Sirdar, 200 feet, Dec., 1899; Virginia, 200 feet, Nov., 1899; Burley, 180 feet, July, 1899; Black Sturgeon, 170 feet, June, 1899; Manhattan, 170 feet, Oct., 1899; AL282, 141 feet, Oct., 1899; Nora, 145 feet; Bad Mine, 122 feet, Feb., 1900; Ursa Major, 117 feet, Sept., 1899; Cameron Island, 120 feet; Bullion No. 2, 112 feet, Dec., 1899; Bully Boy, 115 feet, March, 1900; Black Jack, 110 feet (?), Oct., 1899; Lucky Coon, 108 feet, Oct., 1899; Sykes mine, 108 feet, Feb., 1900; Pettigrew's mine, 108 feet, Oct., 1899; Swede Boy, 105 feet, Oct., 1899; Roy, 105 feet, Oct., 1899; Treasure, 100 feet (?); Scramble, 85 feet; Empress, 417 feet (tunnels) Sept., 1899. Silver mines: West End, 155 feet (about) and 150 feet; Rabbit Mountain, 300 feet (?).

In former years gold was almost exclusively the object of the prospectors, but recently they have turned their attention to the commoner ores of iron, copper and zinc.

Deposits of iron ore have been sought for quite actively, and prospecting work has been carried on for the purpose of testing some of the properties; for this the new railroad is largely responsible.

Prospecting for copper has been prosecuted, but with no very encouraging results so far. The Port Arthur district has been explored for many years, but it is a very difficult country to prospect, and it will not be surprising if deposits of copper remain undiscovered for many years to come; in all likelihood, both copper pyrites and native copper will be found in paying quantities in the region.

Zinc has attracted attention recently on the north shore of lake Superior, and the investment of capital in an enterprise to mine the ore of that metal has had its natural effect in stimulating prospectors to a more diligent search for new deposits. The results appear to be encouraging, and prospecting will probably be carried on actively during the summer.

Silver mining remains very much the same as during the previous year; the future, of course, depends largely upon a variation in the price of silver.

There has been an unusually large number of accidents, especially of those resulting fatally, during the year; but I do not think this undue proportion over previous years is necessarily to be accounted for wholly by any material change in conditions. The law of chance must be taken into consideration. Carelessness in dealing with explosives has been the most prolific source of trouble, and in some cases inexperience is at the foundation of the accident. But the experience of the past year should act as a preventative to a certain extent in the future, if the facts of the accidents are properly made known. I leave instructions forbidding riding in the bucket, skip or cage at all mines, for I find this practice almost universal, and it is dangerous on account of the fact that none of the hoisting plants in western Ontario are properly equipped for such work. There is no doubt that the changes about to be made in the mining regulations will have a beneficial effect.

LAKE OF THE WOODS REGION.

For the sake of convenience I will commence with the mines near Rat Portage, and proceed along the east shore of the Lake of the Woods to Whitefish bay and the country immediately to east of that.

There is quite a group of mines about seven or eight miles east of Rat Portage, and south of this working mines are sparsely scattered all down the eastern shore of the lake in Bald Indian, Big Stone, Andrew and Witch bays, and further south in Regina and Camp bays.

None of the mines of the group near Rat Portage have been extensively developed so far. In fact, none are more than prospects. During the past they have been worked intermittently, usually for only the short period of a few months at a time; there are never more than three or four, or perhaps half a dozen, in operation at once. Some have been abandoned, others are temporarily closed down, and so forth. Among these mines there has been the usual activity during the year. It appears that the future outlook hinges to a large extent upon the sale of the Scramble mine, which has been so much talked of within the past two years. A new era of development will certainly commence among these mines if such a deal is consummated.

BULLION MINE.

There is a property consisting of location 263 P about three miles northeast of Rat Portage, known as the Bullion mine, which has been worked for a few months during the summer. It is owned by the Gold Bullion Mining Company of Ontario, Limited; head office, 808 Prudential Building, Buffalo, New York. A. E. Higgins was superintendent of the mine; only a small force was employed. The work consisted of test-pitting. I did not visit the property.

RAINY RIVER GOLD MINING COMPANY.

Mr. James Weidman, secretary of the Rainy River Gold Mining Company, Limited, with head office at Rat Portage, gave me some notes on properties of the company which had been worked during the year. The company owns a number of locations on different parts of the Lake of the Woods. Operations have been confined to two properties near Rat Portage, viz., the Wimor mine and the Electro-Gold. The Wimor consists of location 289 P, containing 79 acres, situated about six miles east of the town, with good road connection. A shaft has been sunk 85 feet, and a little test-pitting done; a force of six was employed.

The Electro-Gold adjoins the Scramble mine, and is believed to be on an extension of the same ore body. The property consists of the south half of the southwest quarter of lot 13, Jaffray township. A 50-foot shaft has been sunk, and a variable force of from six to ten men was employed.

SCRAMBLE MINE.

The Scramble mine has been examined with a view to purchase by an English company, and it is hoped and expected that the deal will go through shortly. There is an immense ore body (low grade, of course) and only a wealthy company can afford to install a suitable plant for the profitable treatment of the same. Mr. Wm. M. Strong, manager of the Sultana, is also manager of this mine. He spent a few months making a thorough examination of the mine, and a little sinking and drifting was done in the shafts during this time. I visited it on Feb. 9, but no work was going on, and the shafts contained water. It was expected that operations would be resumed soon.

BLACK STURGEON MINE.

The Black Sturgeon mine is situated on Black Sturgeon lake, about 10 miles north-east of Rat Portage. It is connected with the town by a road which is fairly good with the exception of the last two or three miles. The property consists of lot 11, con. 6, Haycock township. The owners are F. W. Gilchrist and P. Oulligan, of Alpena, Mich.

I visited the mine on June 23 for the purpose of investigating an accident, in which three men had been killed a few days previously, and while there I made a regular inspection; the mine has been closed down since the accident. There is an account of this mine in the seventh report of the Bureau.

The present shaft is new work, which has been done since the property has been acquired by the present owners. The shaft is $6\frac{1}{2}$ by 11 feet in size, and is sunk on the vein to a depth of 175 feet. It is vertical for a depth of 60 or 70 feet, then inclined slightly down to within a short distance of the bottom, when it is again vertical. At a depth of 93 feet a drift has been driven west 13 feet, and one east 43 feet. At a depth of 170 feet a drift has been driven west 34 feet, one east 8 feet, and a crosscut south 40 feet.

The hoisting plant consists of a Lidgerwood duplex hoist with 7 by 10 inch cylinders, $\frac{7}{8}$ inch steel wire rope 562 feet long, half ton steel bucket and pole skidway on inclined part of shaft. There is 100 feet of tramway and a half ton car.

The air compressing plant consists of a four-drill Ingersoll Sargeant compressor, a receiver 8 feet long by 36 inches in diameter, and three drills. The boiler is 50 h. p., locomotive style. The drainage pump is stationed at the first level. Buildings consist of shaft house, engine and boiler house, blacksmith shop, office and boarding camps.

Just before closing the total force was 14 or 16, including 10 miners. George Thurber was foreman, and P. Oulligan manager.

The mine is not in suitable condition in several respects. The shaft mouth is not fenced, although trap doors are provided. The ladderway is suitably constructed as far the first level; below this there is only a hanging ladderway to within 20 or 30 feet of the bottom, and it is not partitioned off from the hoisting compartment. The hoist brake is in unsuitable condition. The following instructions were left in the Inspector's Book: 1, Place a suitable guard rail around the shaft mouth. 2, Construct ladderway as required by the Mines Act to within 30 feet of the bottom. Below the permanent ladderway suspend a suitable chain, or wooden ladder, so that miners can ascend and descend between

the bottom and the surface without the use of the bucket. 3, Do not allow riding in the bucket. Post up a notice to this effect in a conspicuous place in the shaft house. 4, I would recommend that the brake be tightened so that a bucket full of rock can be held by the application of the brake alone, without the aid of the friction clutch.

TREASURE MINE.

On Feb. 8, 1900, I visited the Treasure mine, which is situated about seven miles east of Rat Portage. It consists of locations 400 and 409 P, which contains 40 acres each, and is owned by A. B. Upton of Duluth. Work has been going on intermittently, during the past year or two. There is a shaft about 100 feet deep, with drifting and crosscutting at the bottom, but this was full of water at the time of my visit. A new shaft has been commenced, about 100 feet northeast of this one; it was 28 feet deep, and is still being sunk. It is timbered for a depth of 17 feet. Alongside the shaft there is an open cut on the vein 45 feet long, 17 feet deep and five feet wide. Comfortable boarding camps and other buildings are on the property. George Tennant is foreman and contractor. Four miners are employed.

BAD MINE.

On Feb. 8, 1900, I visited the Bad mine, which is situated south of the railway track, about 10 miles east of Rat Portage. The property has been bought by the Bullion Mining Company of Ontario, Limited, and development work resumed after nearly a year of idleness. There was an old shaft on the property about 70 feet deep, and a tunnel driven in at the bottom of the hill, meeting the shaft; the length of the latter is 112 feet. At the time of my visit the shaft had been sunk to a depth of 40 feet below the tunnel, making the total depth from the surface 122 feet. The vein had pinched out where the shaft and the tunnel met, but had widened out to five or six feet at the bottom. There was no ladderway or skidway; the bucket slid on the bare rock. Instructions were given to provide for these deficiencies. The sinking is being done by contract by James Gordon. A force of six miners is employed.

SULTANA MINE.

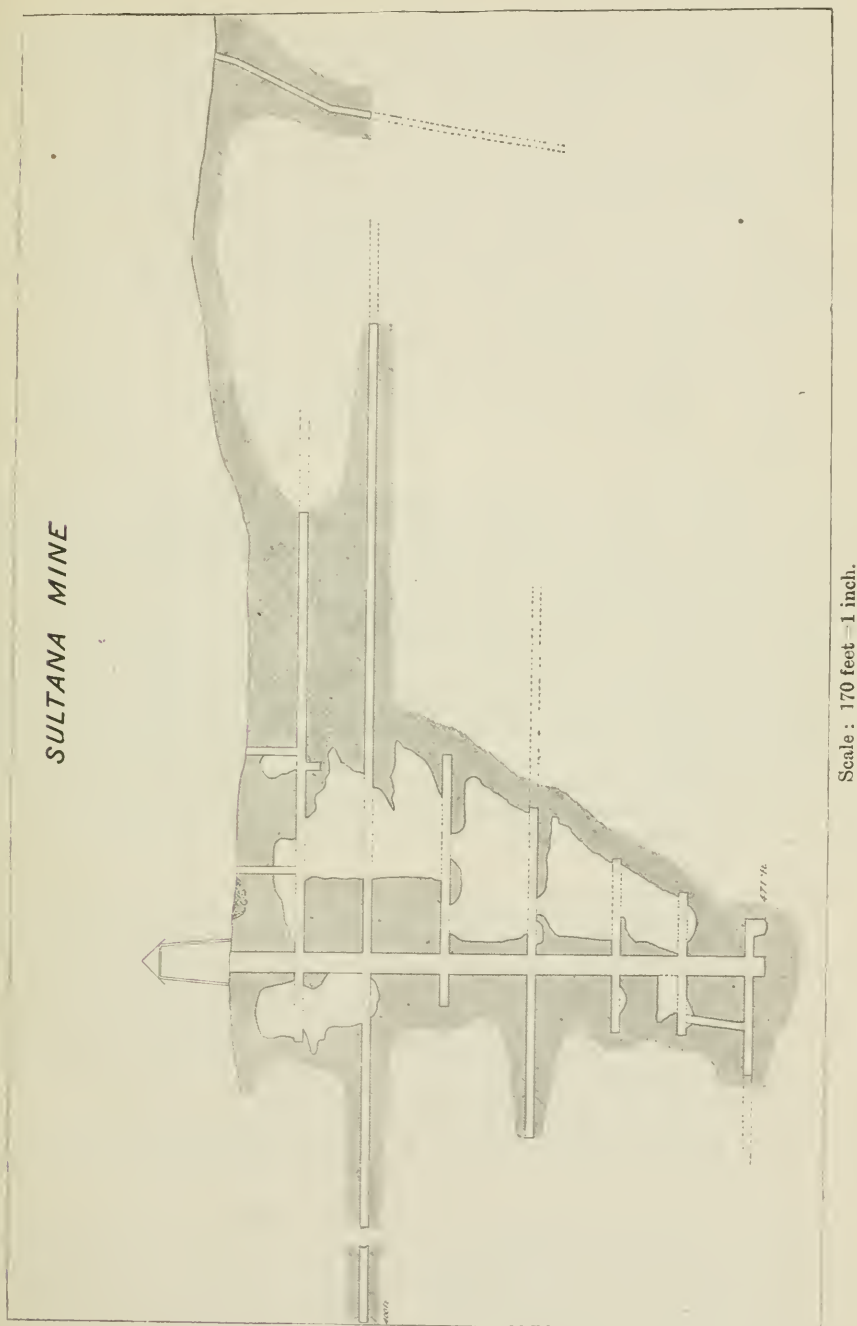
For the past two or three years the report has been periodically circulated that the Sultana mine was sold. For a considerable time extending up to the past year the property belonged to John F. Caldwell of Winnipeg, Man., and it had always been considered by the public in this vicinity a desirable thing that the mine should be in the hands of an English company, in order that the output might be made public and the district advertised in English mining circles through the medium of this property. Under the private ownership the output of the mine was never published, and it was always more or less of a mystery to all but those who were in the inner-circle, or whose business it was to know. Various rumors were in circulation, and various conjectures were made. Some were to the effect that Mr. Caldwell was not anxious to sell; others that he wanted, or was offered, a very large sum, up in the millions; and still other reports were directly to the opposite effect. However, Mr. Caldwell has at length succeeded in disposing of the mine to an English company, receiving in payment fully paid up shares to the extent of the whole of the purchase price.

The name of the new company is the Sultana Mine of Canada, Limited; capital, £275,000 in 275,000 shares of one pound each; head office, London, England. The directors are the following:

Leonard Fawell, Esq., J. P., director Lake View Consols, Limited, chairman; Sir Gerald Fitz Gerald, K. C. M. G., Deputy-Chairman Anglo-American Telegraph Co., Limited; W. Rhodes, Esq., Director Mashonaland Agency, Limited; Wilberforce Bryant Esq., Chairman, Messrs Bryant and May, Limited; John F. Caldwell, Esq., Winnipeg, late owner, Advisory Director in Canada; Secretary, Hugh C. Rabbidge, 32 Poultry, E. C.

The company was formed and incorporated in July, 1899, and the objects of the company are to acquire, further develop and work the Sultana mine, and also any other mining property acquired at any time, and to carry on any other business accessory thereto. A detailed statement of the objects of the company is contained in the prospectus. The

Sultana mine was examined and reported on by Wm. M. Strong, M. E., the General Manager in Canada, and the company have been in possession since Aug. 12, 1899.



The mill was in operation up to Sept. 1, treating ore which had been broken down before the new owners took possession, and which therefore belonged to Mr. Caldwell. Since then it has only been run for a few days each month to dispose of ore resulting from

development work. The new company have started in by doing systematic exploitation without any actual mining of ore, and it will probably be some time before the mill will be in regular operation again.

Operations have been principally confined to the main shaft workings. On the occasion of my last visit of inspection, Jan. 4, 1900, the shaft was 461 feet deep, with a six foot sump below this, and arrangements had been almost completed for the continuation of sinking by subsidiary hoisting machinery, such as has been employed ever since the skip was installed. The following new work has been done underground since last report.

First Level, south: The drift has been driven an additional 58 feet, and the ore stoped out overhead to a height of 35 feet, with a width of 8 or 10 feet, and this stope abandoned. The crosscut, which extends from this level to the air shaft, has been continued to No. 2 air shaft, an old shaft which had been sunk several years ago on a vein behind the mill, and distant 250 feet from the main shaft, following the course of the drifting. Drifting has been carried beyond this shaft to a total distance of 597 feet from the main shaft, and will be continued for some distance farther to strike a body of quartz which is known to exist by surface showings.

At the place where the crosscut from the first level meets No. 1 air shaft a drift has been driven south a total distance of 264 feet from the air shaft, on the "Gagne" vein, and discontinued. Further on in the crosscut another drift, said to be 25 or 30 feet long, has been driven south from the crosscut and abandoned, and the entrance boarded over to prevent access.

No. 2 air shaft has been sunk below the first level a distance of 12 feet, and will be continued. The extension of this shaft below the level is considered an independent shaft, and is known as the "Galena" shaft on account of the large amount of galena that was found in this vein at this point. A drift has been driven northeast a distance of 70 or 80 feet from the crosscut at this point, and abandoned.

Second Level, north: The north drift in this level has been driven a total distance of 400 feet from the shaft, and discontinued for the present. At a distance of 375 feet from the shaft in this drift a bunch of quartz about 10 feet wide was passed through, and the drift widened at this point to ascertain the extent of the quartz body. It was expected that a large body of quartz would be struck in this drift, and further drifting may be done in the endeavour to find it; a mere seam in the rock was followed. At the end of the drift the nature of the rock could be seen on the freshly broken surface; the structure was schistose and wavy, with small stringers of quartz and calcite traversing the face in such profusion as to constitute about 25 per cent. of the whole; this material is said to assay from \$1.00 to \$1.50 per ton.

South: In the south drift the main workings have been described in previous reports. There is a large stope extending up to the first level and down to the third,—in fact with the exception of a little rock left for floors this stope extends to the sixth level. A neatly constructed bridge has been built across this stope at the second level and the tramway laid over same, and a drift has been driven from the south end of the stope for a total distance of 590 feet from the main shaft. This drift is being continued to connect with a shaft now being sunk on the Crown Reef vein, a distance of a little over 100 feet being still required to be driven before the connection is made. There is no vein or seam to follow, and the transit is the only guide.

North of the main stope in this level an overhand stope has recently been made 40 feet long, about 40 feet in height above the floor of the level and about 8 feet wide, and timbered over underneath. This and all other stoping was done previous to the transfer of the property.

Third Level: No work was going on in this level at the time of my inspection; but some prospecting drifts had been run from the main stope south of the shaft, and a little stoping had been done also since last report. One drift or crosscut has been run east under the lake from the east wall of the stope, a distance of 119 feet. The rock at the end of this drift is similar in appearance to that at the end of the north drift in the second level; being full of small stringers of quartz and calcite, and possessing a wavy schistose character; it is said to assay from \$1.00 to \$1.50 per ton.

Another drift has been driven 30 feet northeast from the main stope, and overhand toping in the drift carried up to a height of 50 feet with a length of about 9 feet and a

width of the same. At the top the stope is broken through to the main stope. A third drift has been driven 10 feet south from the main stope.

Fourth Level, north : The north drift in this level has been driven altogether 150 feet from the shaft, and discontinued. The south drift has been driven 155 feet altogether and is being continued to meet the Crown Reef shaft, similarly to the second level.

Fifth Level : No work was going on in this level at the time of inspection. The large stope south of the shaft which extends to the sixth level has been timbered over, providing a floor to the fifth. An opening has been left for ventilation and properly fenced.

Sixth Level : Work was suspended at the sixth level also. The north drift has been driven 55 feet, and the south 60 feet. A winze connects with the seventh level at a distance of 43 feet north of the shaft. The following stoping has been done in this level since last report : North of shaft, length, 40 feet ; height above roof of drift, 15 feet. South of shaft, length, 50 feet ; height, raised to fifth level.

Seventh Level : The seventh level has been established at a depth of 461 feet, and a large loading chamber provided, as at the preceding levels. The north drift is 7 by 7 feet in cross section, has been driven 97 feet and is continued. Two branch drifts have been driven east and west from the main drift, 10 feet and 5 feet respectively.

The south drift is 10 feet in width by 7 feet in height, 33 feet in length, and has been discontinued. A cistern 16 feet square and 12 feet deep has been sunk at the south end of this drift, and two pumps installed.

The skip road has been extended to the seventh level. No other change has been made in the hoisting plant.

On the Crown Reef, which is apparently a good vein, a shaft has been sunk in the open cut, following the vein to a depth of 122 feet, and is being continued. Connection is being made with the levels from the main shaft, as stated before. The shaft on the vein will serve as an air shaft when completed, and all ore will be trammed to the main shaft along the underground levels ; a small hoist worked by compressed air has been installed. A road has been constructed from the shaft to the main surface workings. As additional compressed air has been required, the old straight line compressor previously used on the property has been again installed in conjunction with the present duplex compressor, and an addition built to the engine room for it. A new machine shop has been built and provided with lathe, drill and other machinery. The company intend to build a small foundry so as to be able to make any small castings necessary, and they will also make shoes and dies. No change has been made in the mill or the chlorination plant.

The following new buildings have been erected on the property : Machine shop, manager's dwelling, mill superintendent's dwelling, new sleeping camp, and three private dwellings for employees.

The mine captain is Albert Johnson ; mine foreman, Anton Anderson ; mill superintendent, Alex Cotter. The total force is 85, and the number of miners 30.

The Sultana has the best ladderway of any mine in the district. For a short distance from the surface the shaft is smaller than the main portion, but below this the cross section is 8 by 18 feet, and the ladderway is 8 by 8 feet. It is well cased off from the hoisting compartment to the bottom of the shaft. A portion of the casing between the second level and the surface was blown off by the accidental explosion which occurred in the first level on Jan. 1, but this was to have been replaced immediately. Neatly constructed platforms or landings are provided at intervals of 15 or 20 feet all the way down. The ladders are all heavily constructed, with iron rungs, and are set at convenient angles. The ladderway is convenient and safe for travelling up and down, and should last for many years without repair.

The first and second levels north have been left in a dangerous condition as a result of the explosion mentioned above. The stulls covering the stopes have been blasted away, leaving both levels in a precarious condition. A special report of this accident was made to the Director of the Bureau of Mines. The Galena shaft is not fenced, and is hence in a dangerous condition ; the winze in the sixth level north is in the same condition. Powder has been found lying in open boxes in two or three instances underground, and other evidences of carelessness in the disposal of it have been observed. Ventilation is satisfactory. Drainage is secured by two pumps at the seventh level and one at the fourth. There is a considerable flow of water from the seams in the seventh level, owing to the loose nature of the ground there.

The following instructions were left in the Inspector's Book :

1, Repair casing between ladderway and hoisting compartment between the second level and the surface.

2, If first and second levels north are to be used again, replace stull timbers, which were blown off by the explosion ; or if these levels are not to be used fence off the drifts to prevent access.

3, Provide a guard rail at Galena shaft.

4, Fence winze north of shaft in sixth level.

In consequence of the accident of Jan. 1, the following additional instructions were left in regard to the handling of powder :

5, Keep all explosives and detonators underground in separate chests with lids, and do not allow these materials to be left outside of the chests.

6, Keep all explosives, etc., at a safe distance from the shaft, or where any work is going on, or where men are in the habit of passing.

7, Remove all loose sawdust and empty boxes from the proximity of explosives.

8, Keep powder-thaw cans thoroughly clean.

9, Instruct all miners underground in the proper handling and thawing of dynamite.

BURLEY MINE.

The Burley mine has been closed down since June, 1899. R. H. Flaherty resigned his position as manager in April, and was succeeded by P. W. Webster, who filled this position until the mine was closed down. The shaft was allowed to fill with water. Later on in the season it was pumped out again by J. Burley Smith and examined, and again allowed to fill. Frank Hockley, who is managing Mr. Smith's business in Rat Portage, gave me the following underground measurements of work done since last report : Depth of shaft, 180 feet ; second level at depth of 150 feet ; crosscutting east and west at this level, about 20 feet altogether.

HAY ISLAND MINE.

Operations were resumed for about three months during the summer at the Hay Island mine. I did not visit the property, but got the following information from Frank Hockley, who was superintending the work : The shaft is 103 feet deep ; first level, at depth of 100 feet. A total amount of about 215 feet of drifting and crosscutting has been done at the level. On an average, five miners were employed.

SCOTTY ISLAND MINE.

The Ottawa Gold Mining and Milling Company, Limited, have an option on JC100, a 44 acre location on Scotty island, and have been operating on the property since July, 1899. The location is owned by Frank Gardiner and George Derry of Rat Portage. The company owns JES154, a water location of 96 acres adjoining JC100. The boundary between the locations is the shore line of the island. The vein has a strike of north-east, and outcrops under water parallel and close to the shore. The formation is either chloritic or hydromicaceous schist. I visited the property on Nov. 26 and found a vertical shaft 4 by 6 feet in size, sunk to a depth of 55 feet in the hanging wall, about 30 or 40 feet from the vein. It was timbered and lagged for a depth of 18 feet. A shaft and engine house had been built, and a small duplex hoist with a vertical boiler installed. H. A. Guess, assayer at the Keewatin Reduction Works, is in charge of the work. The total force is 11, and the number of miners eight.

Mr. Guess informed me on Feb 6, 1900, that the shaft had reached a depth of 65 feet ; and at the depth of 60 feet a crosscut had been driven southeast 25 feet, passing through the vein at the end. A drift had been driven 30 feet east on the vein, and a winze had been sunk in the crosscut 15 feet on the vein.

BLACK JACK AND GOLD HILL PROPERTIES.

Early in October the Black Jack and Gold Hill properties, situated in Big Stone Bay and mentioned in previous reports of the Bureau, were acquired by the Britannia

Consolidated Gold Mining Company of Ontario, Limited ; head office, Temple Buildings, Montreal ; president, Dr. Lovejoy ; secretary, Bannell Sawyer. The properties had not been in operation for nearly two years previous to this. Mr. A. B. Upton, the former owner of the Black Jack, had done some work in the shaft just previous to the sale. The manager of the mine is D. O. T. Atkinson, and the foreman Wm. James. At the time of my visit, Nov. 20, the total force was 15, including a variable force of miners of from two to eight.

Mining operations were confined to the Black Jack shaft. The following are the measurements of the old workings : Depth of shaft, about 110 feet (water in bottom). First level, depth, 60 feet ; crosscut north, 130 feet ; two drifts east in crosscut 12 feet and 15 feet long respectively ; drift east from shaft, 35 feet long and 7 by 7 feet in cross-section ; drift west 25 feet long, with same cross-section ; in east drift crosscuts have been driven east and west 6 feet each.

New work : At a depth of 30 feet, stoping east and west from shaft ; length, 10 feet ; height, 15 feet ; width, 3 to 4 feet. A rich pay streak occurs here, and stoping will be continued to the first level. Second level : Depth, 100 feet. A drift 4 by 7 feet in cross-section has been driven west 26 feet, and is being continued.

The ore body is a zone of green schist about 15 feet wide, impregnated with quartz in small stringers ; the strike is northeast. About 100 feet north of the shaft another ore body or " vein " of a similar nature about 25 feet wide occurs, with a strike nearly north and south, joining the former vein about 100 feet from the shaft. The crosscutting at the first level was done to reach this vein, and the drifting at the second level is for the purpose of reaching the junction.

The shaft had been left in poor condition by the previous operators, but a considerable amount of timbering has since been done. The walls are loose and require frequent attention. A ladderway extends to the bottom, but is not in good condition. Instructions were given to case it off from the hoisting compartment, and also to fence the shaft's mouth. The pump is situated at the first level.

The machinery is all old. It consists of an Ingersoll duplex hoist with 6 by 8 inch cylinders and 36 inch drum, $\frac{5}{8}$ inch steel wire cable, wooden kibble sliding on a pole skidway, and 18 h.p. locomotive boiler. Three sheaves are employed, the shaft house being at the top of a hill and the hoist at the bottom. The buildings consist of shaft house, engine and boiler house, office, blacksmith shop and boarding camps, all of which had been erected by the previous owners.

On the Gold Hill there is an old ten stamp mill, which has not been in operation for several years. It is being renovated and will be used to make mill tests, etc. On Jan. 22 Mr. Atkinson informed me that no work was going on at the time, and that the old dumps on the property were being treated at the mill. The mill has been burned down since my visit.

TRIGGS MINE.

The Triggs mine, which is mentioned in last year's report, was visited on Sept. 2. Some additional locations adjoining have been secured by the company, and the property now consists of the following : McA56, 129, 130, 134, 148, 189 and 190, aggregating 280 acres.

The main shaft, which is vertical, was 150 feet deep at the time of my visit, further sinking being suspended pending the arrival of steam hoisting machinery. At a depth of 40 feet a drift has been run 30 feet west and abandoned. The first level is 108 feet from the surface. A crosscut 4 by $6\frac{1}{4}$ feet in cross section has been driven north 55 feet, and is being continued. Suitable timber sets are provided at intervals of every five feet in depth in the shaft, with lagging where required. A neat and roomy manway has been constructed as far as the first level, suitably cased off from the hoisting compartment and provided with platforms. The man-holes in the platforms were unnecessarily large, and instructions were left to have them reduced about one-half. Instructions were also left to provide a guard rail across the hoisting compartment at the first level and round the shaft mouth. Water is removed by bucket ; a hand blower with pipe extending down the shaft is employed for ventilation ; blasting is done by battery ; drilling by hand. The

hoisting plant consists of a Colorado whim, with hand brake applied at shaft mouth, a 14 foot iron head frame, $\frac{1}{2}$ inch steel wire cable and iron kibble. I have been informed since that the steam hoisting plant has been installed.

On McA 130, one of the recently acquired locations adjoining on the west, a 5 by 8 foot shaft had been sunk 67 feet by the previous owners, and work had not been resumed in it by the present company; instructions were given to fence it. It is situated at a distance of 1,160 feet west of the main shaft on an extension of the same ore body, which is at this point about 125 feet wide, and consists of trap broken up, and filled with quartz stringers. There is a 14 foot test pit about 50 feet southeast of this shaft, besides other small pits at various places on the property.

There is said to be a 30 foot shaft on McA 138, sunk by the former owners, but as operations were not in progress there I did not visit the place.

Buildings consist of shaft and engine house, blacksmith shop, stables, office, boarding camps, store house, dwelling house, and also boarding camps on the newly acquired locations. The force consists of 13 men, including 6 miners. T. F. Philbrook is foreman and J. H. Triggs manager.

WENDIGO MINE.

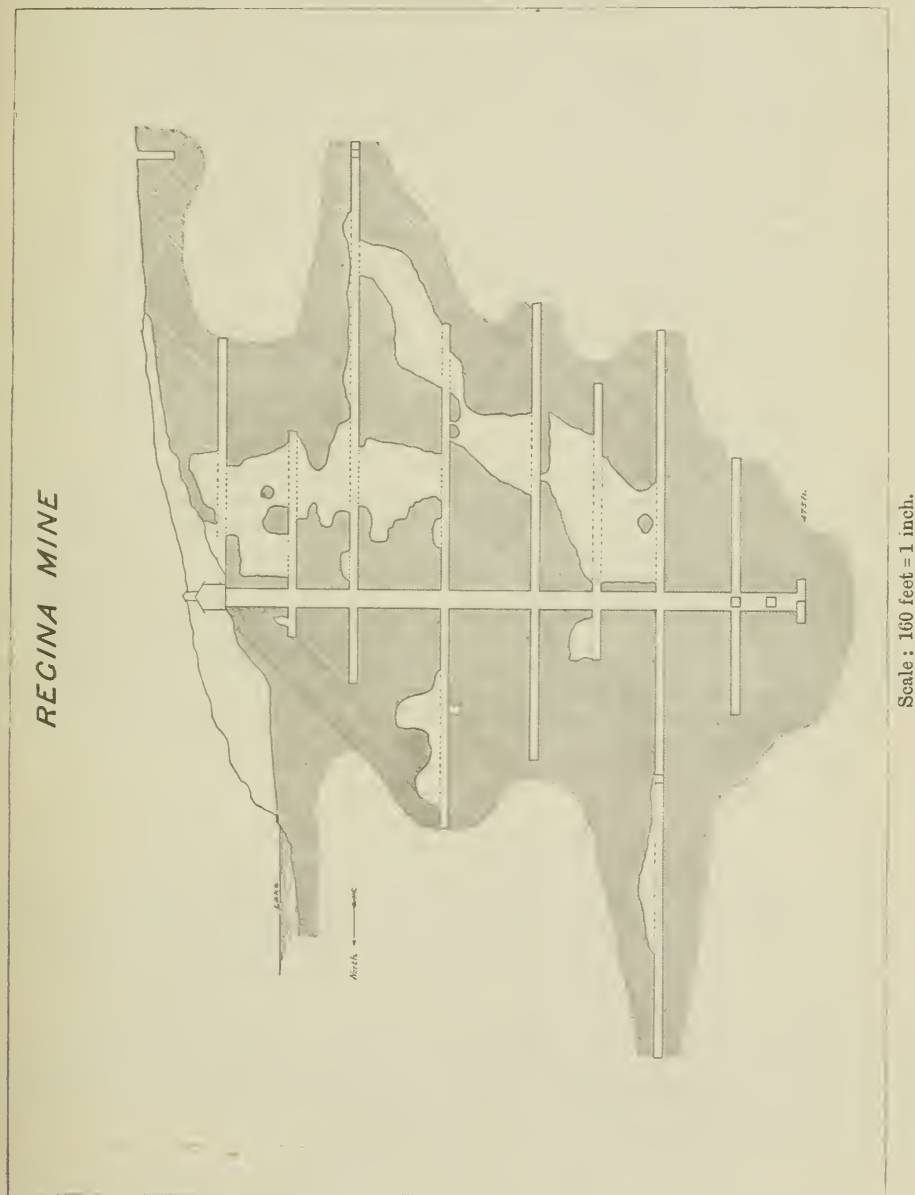
Mr. Matthew Hunter, late manager of the Sultana mine, gave me the following notes on a new property which he is opening up on Witch bay, Lake of the Woods: The property consists of three locations, MH208, 209 and 210, and is situated south of lake La Belle, north of Witch bay; it has been christened the "Wendigo," in keeping with the name of "Witch" bay. The owners and operators are a syndicate of Canadians, among whom are Charles Gooderham, Wm. Mackenzie, Sir Richard Cartwright, Clarkson Jones and others. The head office is 37 Yonge St., Toronto.

The formation on the property consists of a variety of schists. The ore body is a quartz vein 8 feet wide, and traceable for 375 feet. One shaft has been sunk 60 feet, and a second has been started. Drifting has been commenced in the first shaft towards the second. Amalgamation tests of 100 lb. each have been made every 10 feet in depth in the shaft, yielding an average of \$16 per ton. Work has been going on since Dec. 5, 1899. Mr. Hunter is manager. A total force of 25 is employed, all miners except one.

REGINA MINE.

The Regina mine has been in operation intermittently during the year under the management of J. F. Mievile. In the latter part of October work was suspended altogether and the shaft kept pumped out, awaiting examination with a view to the transfer of the property. The present mill, which has been described in last year's report, was installed by H. A. Pringle, the former manager; and lack of funds to provide a proper mill was the reason for departing from the usual custom of employing gravity stamps and Frue vanners and substituting Tremaine steam stamps, jigs and Berdan pans. An endeavor was made to obtain a plant which would treat a considerable quantity of ore and could be installed at a minimum of expense. It is well known that Tremaine mills are much cheaper as regards first cost than gravity mills, and in the matter of capacity a Tremaine two-stamp mill is claimed to be equal to a gravity battery of five stamps, crushing from 10 to 15 tons per 24 hours. But this capacity was not obtained at the Regina. From 40 to 50 tons per 24 hours seemed to have been the best results that could be obtained from the seven mills, or 14 stamps, which had been installed there. There was always a considerable amount of trouble in keeping the batteries in adjustment and in regular operation. But how much of this was due to the incompetence of the mill men and how much to the defects of the machinery, I am not in a position to say; however there is no doubt but Tremaine mills are much inferior to gravity stamps in a mill of this size. Tremaine mills, on account of their cheapness and portability, are more suitable for prospecting purposes. Another thing, a large quantity of fuel was required to supply steam for the 14 cylinders. The Berdan pans were stoped, being considered useless. On the whole the mill gave poor satisfaction, and it will in all probability be replaced by a gravity mill when a new company takes hold of the property.

The cyanide plant was kept in operation until all the concentrates were treated. A treatment of about four weeks duration at least is given, but on account of the surplus capacity the length of treatment was usually extended to five or six weeks. A new furnace has been built for roasting the cyanide slimes and retorting.



The shaft is now 475 feet deep. No drifting has been done above the sixth level since last annual report. The north drift in this level has been driven $380\frac{1}{2}$ feet altogether. At the seventh level, the north drift is 85 feet in length, and the south 120 feet. At a depth of 452 feet a crosscut has been driven east 18 feet, cutting the vein, which at the seventh level dips into the hanging wall. At the bottom of the shaft the eighth level has been established with cross-cutting north 18 feet, passing through the vein and drift-

ing north and south on the latter, 35 feet altogether. These are the measurements of Oct. 14, the date of my last inspection. In the third level north, at a distance of 90 feet from the shaft, a raise has been sunk 12 feet, revealing a good width of vein.

The following are the dimensions of the stopes in the levels where this work has been going on since last report. Fourth level, south: average length, about 50 feet; height, raised to third level. Fifth level, south: length, 120 feet; height, 36 feet above roof of drift, and broken through to fourth level at a distance of 95 feet from the shaft. North: length, 35 feet; height, 18 feet above roof of drift. Sixth level, south: length (average), 85 feet; height raised to fifth, leaving pillar 12 feet in diameter in lower part of stope for support. North: length, 135 feet; average height, about 5 feet above roof of drift. Seventh level: raise commenced 20 feet south of shaft.

The vein in the lowest workings is wider than usual, and possesses good walls. At the seventh level it is 7 feet wide at the shaft, although narrower in the drifts. At the end of the crosscut, at a depth of 452 feet, the width is 6 feet; and at the 8th level, it is 7 feet 8 inches, with good walls and selvage on hanging. At the ends of the drifts in the eighth the vein is narrower, ranging from 4 to 6 feet. Mr. Mieville tells me that the ore averages about seven dollars per ton. The mine looks very encouraging, therefore, at the lower levels, the vein being much stronger than on surface; and it is hoped that the disposal of the property will be effected in the near future in order that it may be given a fair test. No change has been made in the hoisting or drilling plants, or in the mill. Last winter a tunnel was driven 30 feet south on a vein about 900 feet east of the main vein, and discontinued.

At the time of my inspection of April 12 there was a total force of 50 men, including 16 or 18 miners. Drifting and stoping were in progress, and the mill was running 10 hours out of the 24. On June 20, the time of my second visit, the total force was 20 with 4 miners. Sinking in the main shaft was the only work being done. The mill had been stopped on May 7. The mine was visited on two more occasions, Oct. 14 and Nov. 25.

The mine was in satisfactory condition, with the following exceptions: The ladder way below the seventh level is not cased off from the hoisting compartment, or otherwise constructed according to the Mines Act. Instructions were left to have this attended to, and also to fence the winze in the third level south.

A fatal accident occurred in the shaft on June 1, and a special report on it was sent in to the Bureau.

STURGEON LAKE REGION.

The Sturgeon Lake or Deer Lake country east of the Regina mine, or of Whitefish bay, is attracting a considerable amount of attention at present. There are now four properties upon which substantial development work is in progress, and a 15-stamp mill is being erected on one, the Gold Panner. This will, according to present indications, prove to be a region of large low-grade as well as small high grade propositions. There will doubtless be a number of new properties opened up during the coming season. The Anglo-Canadian Gold Estates, Limited, of London, Eng., which is one of the companies operating here, is a strong corporation, and will not hesitate to supply all necessary means to prove the value of their properties. The Virginia mine is owned by a substantial company, and a stamp mill will probably be erected soon.

VIRGINIA OR LIZZIE MINE.

This property, which has been named the "Lizzie," but is better known as the "Virginia" mine, was visited by me on Nov. 21. With the exception of a short period of suspension of work, active mining operations had been carried on since my previous visit of about a year before. Work was principally confined to the main shaft, but the following test-pits have been sunk on the vein also: (a) 600 feet south of main shaft; pit, 12 feet deep. (b) 400 feet south of shaft; pit, 9 feet deep. (c) 150 feet north of shaft; pit, 9 feet deep. Good values are said to have been obtained from all three.

The main shaft has been sunk to a depth of 198 feet, and is being continued. The cross section is 6 by 8 feet, and the dip 60° east. At a depth of 100 feet a drift has been driven north 12 feet. From the end of the drift a $3\frac{1}{2}$ by $6\frac{1}{2}$ foot crosscut has been driven northwest 102 feet, and one southeast 38 feet, making a total distance, including the width of the drift, of 144 feet. As stated in last year's report, the formation here consists of a band of fine-grained schist, apparently felsitic or sericitic, in which the vein is bedded. The crosscut was made to test the schist, 100 feet of which was passed through. The northwest end of the crosscut is in the granite, and the southeast wall of the schist is also believed to have been reached. Small stringers of quartz and decomposed belts occur in the schist at intervals; the whole body is claimed to be ore. It resembles the Olive and other properties on that belt of schist in the Lower Seine to a certain extent. The formation extends for miles, and if it is found that the whole width of the schist, or even a considerable portion, carries sufficient value to pay for treatment, the amount of ore will be practically unlimited. The vein proper in the shaft consists of stringers of quartz mixed with the schist. The second level will be established at a depth of 200 feet, and another crosscut will be made there similar to the one at the first level. The hoisting plant consists of the following: A Rand duplex hoist with 6 by 8 inch cylinders, $\frac{3}{4}$ inch steel wire cable, 20 h.p. locomotive boiler, two pole, iron-shod skidway, steel bucket, 30-inch sheave, and neat and substantial shaft house. The shaft has been timbered for a depth of 20 feet. A suitable ladderway has been constructed to the first level, but is not divided off from the hoisting compartment. Below the first level the ladderway is temporary and extends to within 20 feet of the bottom. Instructions were given to construct the ladderway suitably, and also to fence the shaft mouth. Ventilation is secured by means of a 10 by 12 inch wooden boxing, which extends down the shaft and conducts the exhaust steam from the pump at the first level, and also receives an up-current for the removal of smoke, etc., by a jet of live steam at the bottom. A Cameron pump, with $1\frac{1}{4}$ -inch suction, is stationed at the drift at the first level. A 3 foot cistern has been sunk in the drift, and a dam 2 feet high constructed at the north end of the drift, so that the whole crosscut serves as a reservoir. Blasting in the shaft is done by battery.

The following new buildings have been erected since last year's report: Shaft house, engine and boiler house, dining camp, barn, ice house and manager's dwelling. The latter is a large building and is neatly and artistically constructed; in fact it is the finest log house in the district.

S. H. Brockunier, the secretary-treasurer of the company, is general manager of the mine, and James Rayburn is agent. The total force is 12, including 8 miners.

The company have secured the small steamer "Jenny Linn," with 40-foot keel, for running on Sturgeon lake, over which a distance of 14 miles is traversed from the mine to Dog-Paw rapids. The small naphtha launch runs on Whitefish lake, a distance of 4 miles, completing the connection to the portage into Lake of the Woods. Facilities of transport are thus greatly increased by this service. In the winter time a regular stage will run from Rat Portage to this and the other mines in this part of the district two or three times a week, carrying passengers and the mail.

NINA MINE.

About four or five miles north of the Virginia there is a property familiarly known as the "Scovil-Moore" property, of which considerable has been heard. It is now being worked under bond by the Great Granite Gold Mining and Development Company of Ontario, Limited, which is operating on Shoal lake, near the Mikado. The property consists of JES 93 and 110. S. H. Reynolds is manager of the mine, and it was from him that I got this information. A shaft has been sunk 60 feet and a tunnel is driven 24 feet. The vein is said to be very fine in appearance, and to be traceable for a long distance.

ANGLO-CANADIAN GOLD ESTATES.

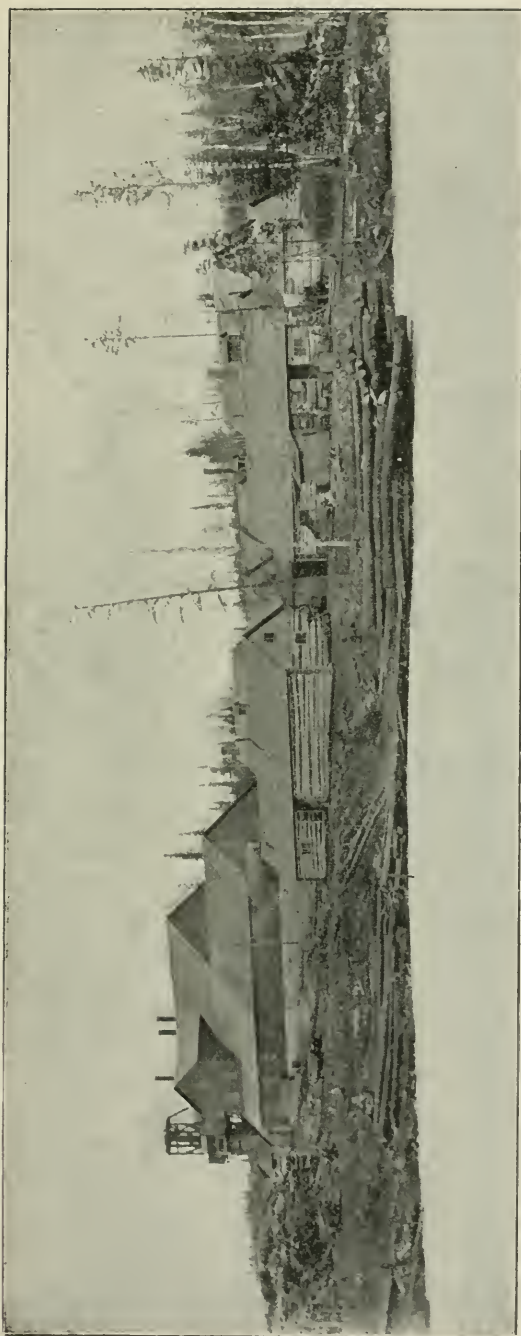
In view of the failure of the Ontario Gold Concessions, Limited, of London, England, a company of first class English capitalists to discover anything of value on 100 square miles of territory, which was supposed to be in the gold bearing formation of western Ontario, it was anticipated that capitalists from that country would in the future

be less inclined to make ventures in this district, and the public here deplored the want of success of the company, fearing that a severe set back to the district would be the consequence. But instead of such being the case, the persistency of English capital has been demonstrated in the present move, in which another effort is being made in the direction of discovering gold by the prospecting of large, hitherto unexplored areas. The Ontario Gold Concessions, Limited, under a certain agreement secured by special authority from the Government the sole right of prospecting, and buying any portion of two large areas, aggregating 100 square miles, in parts of the district where no location had been applied for or where no timber limits existed, and selected by reference to the Dominion geological map without any practical knowledge of the country at the places chosen. Now a considerable portion of our district is surveyed into and leased as timber limits, many of which are likely to be retained by lease for years to come. No power is given the lessees over the mineral rights of the limits, but the Department prohibits the entering of persons upon them for prospecting purposes, and will not recognize applications for mining locations upon them. And further, the best timber often or usually grows on the best gold-bearing formation. The reason for this is obvious: The hard and rounded Laurentian granite will not hold the soil, and hence afford foundation for the growth of timber, as well as the softer schistose Huronian formations. For this reason much of the country valuable from a mining standpoint is tied up. Mr. Alan Sullivan, who was manager of one of the blocks of the Ontario Gold Concessions, Limited, recognized and had in view the above facts, and by considerable perseverance and expenditure of time succeeded in interesting prominent English mining men (not the same who were in the previous venture) in the scheme of prospecting these limits, or some of them, by securing permission from the lessees, this not being contrary to the law. Apparently with the consent of the lessees surveyors may enter and survey, and the Government will patent or lease locations on timber berths. The name of Mr. Sullivan's company is the Anglo-Canadian Gold Estates, Limited; capital, \$305,000, or £61,000; offices, 9 and 10 Pancras Lane, Queen Victoria st., E. C. London, England. The following are the directors: J. Douglas Fletcher, Rosebaugh, Rosshire, N. B.; Thomas Greenwood, (Director Union Financial Syndicate, Limited); S. W. Paddon (Director the London & Westralian Mines & Finance Agency, Limited); W. Marshall Philip, M. E., Assoc. Mem. Inst. C. E., The Anchorage, Enfield; N. G. Maitland Smith, Moorgate Court, Moorgate Place, E. O.

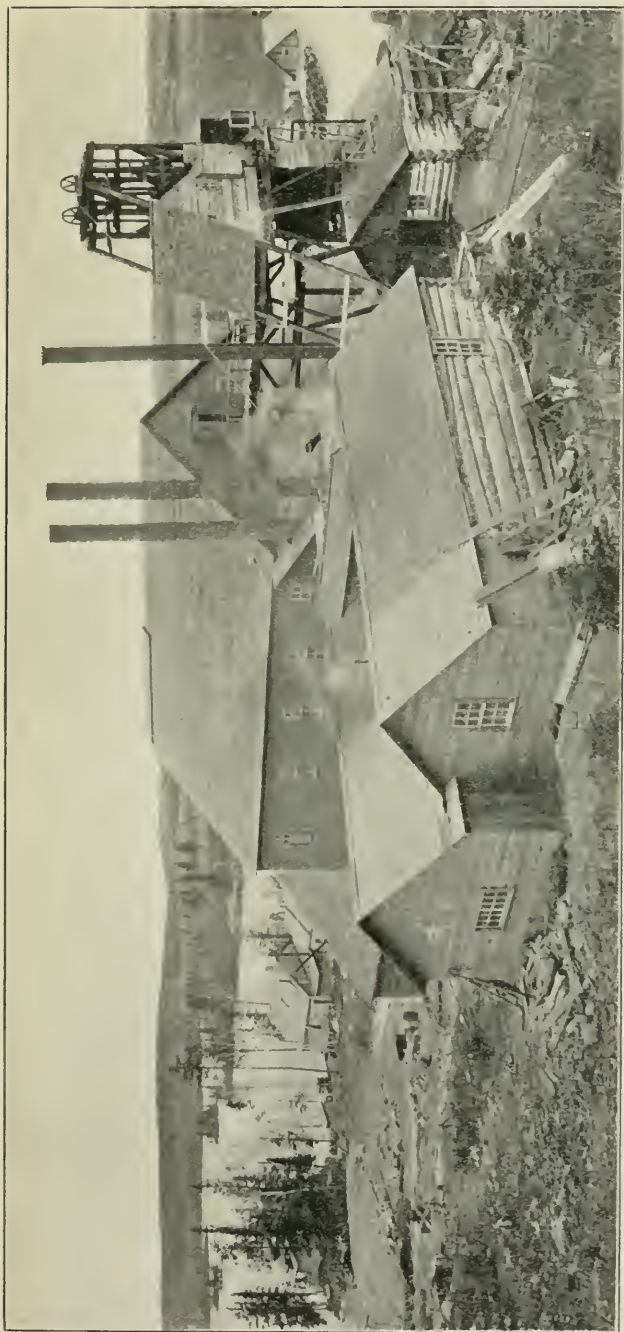
The company was formed purely for prospecting and development purposes. The sum of \$200,000 has been subscribed for working capital. This is to be employed solely for bringing properties to a certain stage of development without installing any regular mining machinery. When it is established that a proposition has developed into a mine, a subsidiary company will be formed to take over the land, and additional capital will be subscribed.

Alan Sullivan, M. E., is manager in Canada. He went over to England in the winter of 1898-99 and remained there until the formation of the company was completed, and commenced work immediately upon his return. A suitable gang of prospectors was selected and operations were commenced in August, 1899, on timber berth No. 5 on Denmark lake, east of the Lake of the Woods, there being a number of timber limits in that section of the district, and some good finds have been made there. I visited the place where work is in progress on Nov. 22. It is reached by way of the route to the Virginia mine, until within about two or three miles of that place, where a turn to the right or east is made. The following route is then passed over: Two miles up a creek to Ross lake, which is entered by a short portage of 50 yards; $1\frac{1}{2}$ miles across Ross lake, a quarter mile portage over a good road into Denmark lake, and a 10-mile voyage on the latter. The property is situated at the foot of the long bay extending southwest. A small steam launch has been put on this lake by the company. A regular stage will run in the winter time.

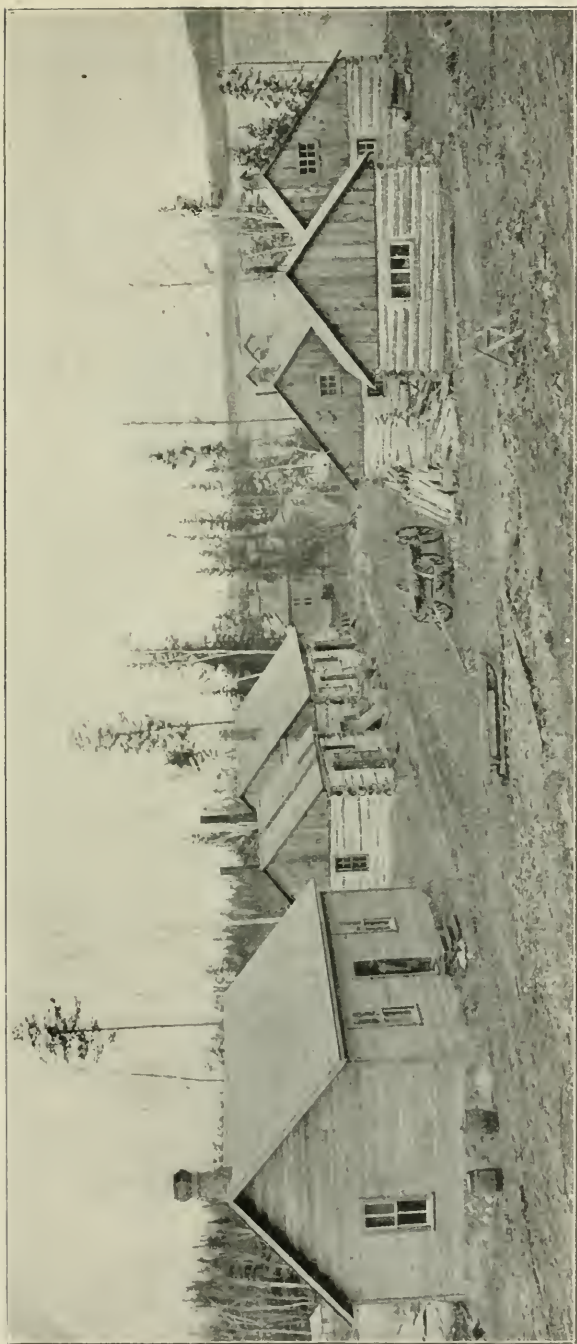
Two locations, FM131 and 132 containing 80 acres, have been surveyed. The formation is a hard, dark-colored, fine-grained porphyry mixed with greenstone. On FM131 there are two distinct quartz veins. One has a strike of north 30° east, and is traceable and stripped for about 150 feet, having a width of from a few inches to two feet. The other vein has a strike of nearly east and west. It is traceable by stripping for about the same distance as the other, and has a width of from a few inches to three feet.



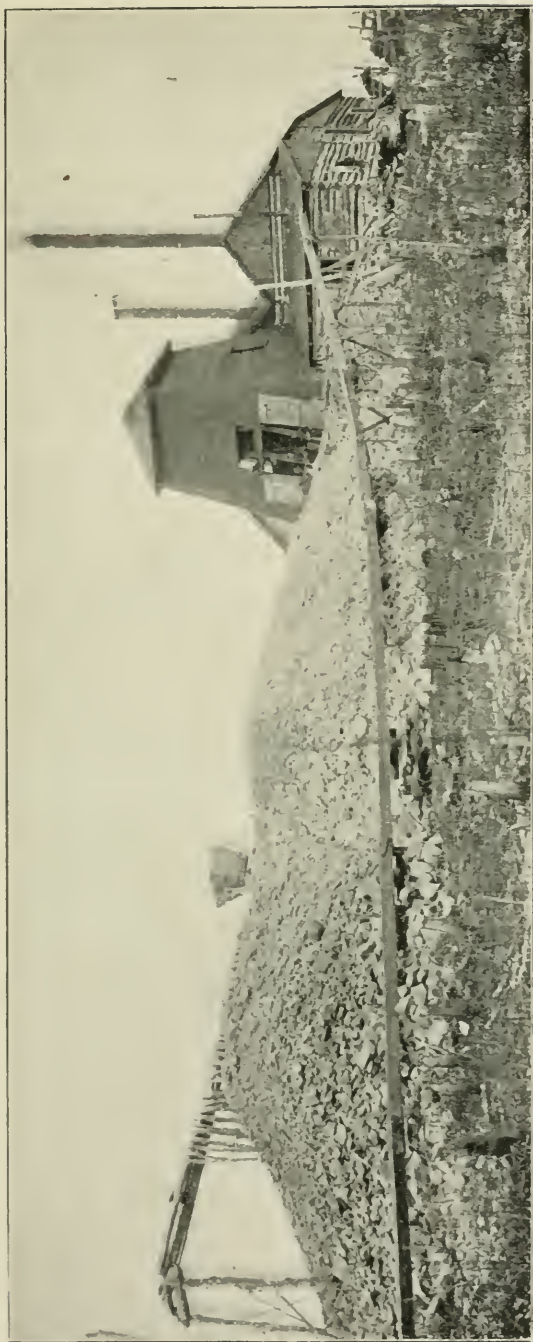
13. Mill, Shaft House, Cyanide Works and Camp of Mikado Gold Mine, p. 52.



14. Mill and Shaft of Mikado Gold Mine, p. 52.



15. Camp, Office and Manager's Dwelling of Mikado Gold Mine, p. 52.



16. Shaft House and Ore Dump of Sirdar Gold Mine, p. 56.

A 5 by 8 foot shaft, with a dip of 70° northwest, has been sunk on the junction of the two veins to a depth of 60 feet, and is being continued. The east and west vein is three feet wide at the surface, but the hanging wall of the shaft is apparently the line of faulting of the vein, as it is not exposed further down, nor does it occur on the other side of the shaft even on the surface. The first mentioned, or No. 1 vein, is only 8 or 9 inches wide at the bottom, and the values are said to be low. But Mr. Sullivan told me subsequently that further sinking and crosscutting had exposed a fairly good-sized body of quartz assaying from two to three ounces. Hoisting is done by windlass and bucket, a large stone being employed as counterpoise. A steam hoisting plant is being brought in, and machine drills operated by steam will also be installed. A ladderway extends to within 15 feet of the bottom of the shaft. A test pit seven feet deep has been sunk on the east and west vein at a distance of about 150 feet from the shaft.

On the other location, at a distance of 800 feet southwest of No. 1 shaft, a shaft has been sunk to a depth of 30 feet on what is believed to be the same vein, which runs northeast on the preceding location. But here the vein is much broken up, consisting of stringers of quartz mixed with the porphyry. Some specimens containing visible gold were shown me, and I was told that much visible gold was found along the surface of the vein. On the line between the locations a tunnel has been driven west 60 feet, on a body of quartz mixed with country rock about 15 feet wide at the foot of a bluff about 100 feet high. The quartz pinched out in the tunnel, and a crosscut $7\frac{1}{2}$ feet long driven west from the end of the tunnel did not reveal any evidence of the continuation of the vein.

The total force is 25, including 13 miners. Alan Sullivan is manager, and H. Patterson is foreman of the work.

A number of buildings, including boarding camps, private residence, offices, etc., have been erected.

GOLD PANNER MINE.

About four miles south of the Virginia mine on Sturgeon lake there is an island of 22 acres, which has been surveyed into mining location MH230 and is the property of the Gold Panner mine. It is owned by The Gold Panner Mining Company of Ontario, Limited; capital, \$999,999; par value of shares, \$1; head office, Rat Portage, Ont.; president, M. Kyle; secretary-treasurer, John Chaloner; managing director, Richard Hall. The company own other locations in the vicinity, but this was the only one visited, and the only one in operation at the time of my visit, although work had been done on one or more of their other properties during the year.

The formation consists of a belt of fine-grained schist, similar to that of the Virginia and parallel to it. A shaft 8 by 12 feet in cross-section and 15 feet in depth was being sunk at the time of my visit, Nov. 23. The vein is 8 feet wide, extending across the whole width of the shaft. It consists of a zone of the schist, mixed with quartz stringers; about one half being quartz. The dip is almost nil. The walls are well defined, but on account of the schistose nature of the formation other walls may be obtained, and perhaps more quartz, by cross-cutting. Oxidized streaks extend through the vein, and the schist is much altered in places. The whole vein is well mineralized; it is said that much visible gold is found in it. I was shown some splendid specimens that came from the mine in the office of the company at Rat Portage.

Between two and three hundred feet northeast of the shaft a test pit has been sunk 8 feet in the schist, where for a width of 8 feet the schist is mixed with quartz, but to a less extent than in the main shaft. This pit is not on the same line of strike as the shaft, being 50 feet or more to one side. It is possible that the whole body of schist, which is probably over 100 feet in width, will prove to be ore.

Six miners were employed at the time of my visit. Richard Hall, the managing director of the company, is manager of the mine, and Fred. Goulet mine captain. Work has been going on since the latter part of October, 1899. In March, 1900, Mr. Chaloner, the secretary, informed me that a 15 stamp mill was on the property in course of erection.

CAMP BAY MINES.

Activity has increased in the Camp Bay locality during the year. Some of the old mines have renewed operations, new prospects have been opened up, a stamp mill has been erected, and although work had been suspended at one mine the future prospects for this locality are encouraging.

COMBINED GOLD MINES CO.

The property of the Combined Gold Mines Company of Ontario, Limited, had also been closed down for some time, and operations were resumed this past summer. I visited the place on Oct. 17 and Nov. 25. There are several veins here upon which shafts have been sunk, but the principal ore body is a flat-lying quartz vein, which probably will average between two and three feet in thickness, underlying a capping of greenstone of about the same thickness, although the quartz is exposed at a number of points. Test pits and trenches have been made, revealing the thickness of the quartz body at various points. It is impossible without further investigation to say what the extent of the ore body is ; it may be several acres or more ; from one-half to three-quarters of an acre has been cleared for mining purposes. About 1,300 tons have been blasted out along a face of about 200 feet in length, where the deposit has been attacked for mining purposes. Test pits have been made at other places, showing the vein to gradually dip into the trap on the west. The company believed they had a sufficient quantity of ore in sight to warrant the erection of the 10 stamp mill now on the property and just completed. It is expected that the ore will average between five and ten dollars per ton.

The mill is a Fraser and Chalmers, and has been erected under the superintendence of D. V. McKillican, who represents that firm. The machinery consists of the following : Two batteries of five stamps each, a Blake crusher with 7 by 10 inch opening, three-compartment Brown's hydraulic sizer, three Frue vanners with six foot belts, two smooth and one corrugated, a 40 h.p. Corliss engine and a return tubular boiler 14 feet long and 60 inches in diameter. The building, which is neatly constructed, is of the following dimensions : Battery room 36 feet 8 inches by 42 feet, vanner room 36 feet 8 inches by 22 feet, engine and boiler room 22 by 31 feet. It is situated on Camp bay, on a convenient and well chosen site.

As the mine is about two miles back from the lake a railroad, called the "Camp Bay and Crow Lake Railroad" on account of its proximity to these two bodies of water at either end of this length, has been constructed to convey the ore to the mill. There is practically no up-grade in going towards the mill, and there are no steep grades in going the other direction until close to the mine, which is situated on top of a hill ; two switch-backs with steep grading are necessitated. The track is of 4 feet 7 inches gauge, the construction of which is interesting. Any person acquainted with the country in this part of the Province will realize the difficulties and expense involved in the construction of railroads therein. The country is principally a succession of rocky elevations separated by muskegs or swamps and lakes, with only occasional areas covered with firm soil. Thus there is involved continuous rock-cutting, grading, bridges, trestle work, curves, etc., and the muskeg always affords very poor foundation even with considerable filling or grading. Now the body of ore on this property would not warrant the construction of an expensive railroad for such a distance, so a cheap method of construction had to be employed. The road was made to follow the level ground, and hence the muskegs as far as possible, so as to avoid rock cutting. Trestle work and cribbing have taken the place of filling. At the mill end, for a distance of about 200 yards, the track is supported on a series of trusses set 16 feet apart. For the rest of the distance, where the elevation is sufficient to require it, a cribwork about 6 feet in width and 6 to 12 feet in length, consisting of logs from 6 to 8 inches in diameter, is built up at intervals of 16½ feet between centres. The elevation at the highest point is 11 feet. A heavy cross-piece is provided on top, and on the ties rest heavy stringers 16½ feet in length, notched into the cross-pieces. The rails weigh 16 pounds to the foot, and are spiked directly to the stringers, no cross-ties being employed. The whole affair, where the track is elevated, is shaky and insecure. Where the road passes through the muskeg the timbers are laid on the bars

ground. This, as would be expected, is a very soft and yielding foundation, and a continual sinking must always result (except when the ground is frozen hard), as has proven to be the case at a number of points examined. The effect of the frost must also be disastrous. The track yields under the train; the cribwork and the soft muskeg forming a springy combination. Experiment proved that the stringers were not sufficiently stiff, and centre supports had to be provided all along. The rails are too light for the engine, and the spiking is not sufficiently strong, as spreading of the rails was observed in several places. Cross-ties should have been employed. The train consists of a nine-ton locomotive, and two cars which are supposed to carry three tons each. The road was almost completed at the time of my last visit, and was being used for hauling cordwood from various points along it to the mill.

A dock has been built close to the mill, where there is a good depth of water for steamboats.

As regular mining and milling had not commenced, the force was variable. At the time of my visit of Oct. 17 seven miners were employed, and this will probably be the number when regular work commences. W. H. Crocker is manager of the mine, A. Patterson is superintendent, and W. H. Rudd assayer and amalgamator.

BOULDER MINE.

I visited the Boulder mine on Oct. 17 and found it closed down, with nobody there but a caretaker. A neat and roomy shaft and hoist house was erected at the main shaft. The hoist and the compressor were installed, and the surface arrangements were neat and convenient. The shaft being full of water, I could not go underground.

GOLD SUN MINE.

Other properties have been and are in operation in this vicinity, but they were not visited. I got some information from Mr. A. A. Atwater, manager of a property consisting of locations JC81 and 97, and FM145, situated northwest of Crow lake, and owned by the Gold Sun Mining Company, Limited; head office, Windsor, Ont. Six miners were employed all summer. Two tunnels, 45 and 70 feet long respectively and 600 feet apart, had been driven to cut the same vein, besides stripping and blasting along the surface.

BULLY BOY MINE.

Work on the Bully Boy mine was resumed on Nov. 12, 1899, after having been suspended for over a year. It is under option by Geo. J. Ross of Rat Portage and A. B. Upton of Duluth. Mr. Ross is manager of the mine; J. M. Jores, formerly of the Regina, is mine captain. At the time of my visit, Nov. 25, the total force was nine, including six miners. No work was going on in the main shaft, as it was full of water and they were awaiting the arrival of pumping machinery. In the meantime a pit was being sunk several hundred yards north, on what is considered the same dike or vein. The pit was 12 feet deep at the time of my visit.

Mr. Ross, the manager, informed me on March 13 that the main shaft had been pumped out and sinking resumed. A depth of 115 feet had been reached. A steam hoist is installed.

TROJAN MINE.

I visited the Trojan mine on Nov. 24, and found operations in progress in No. 1 shaft on the hill side. This shaft was 70 feet deep, when work was suspended nearly two years previous, and at the time of my inspection was 91 feet; sinking is being continued. A new shaft house and blacksmith shop and a hoist house have been erected; and a small, Jenckes duplex hoist with 25 h.p. locomotive boiler installed. The shaft is suitably timbered at the surface, but is not provided with guard rail at the mouth. The ladderway is in poor condition, no division or platforms being provided; the skidway is also insecure. The attention of the captain was called to these defects, and instructions were given to remedy them. A shaft house is being erected at No. 3 shaft on top of the hill, with a view to commence work in a few days. The total force of miners is 10; mine captain, James Vear; manager of mine, Geo. J. Ross.

I was informed by Mr. Ross while in Rat Portage that the mine was being operated under option by a syndicate consisting of the following : James F. Lewis, Chicago, president of the Canadian Rand Drill Co.; S. W. Jenckes, president of the Jenckes Machine Co.; J. M. Jenckes, sec.-treas. of the Jenckes Machine Co.; E. W. Gilman, general agent of the company, and Geo. J. Ross of Rat Portage. Mr. Ross also informed me on March 13 that No. 3 shaft had been reopened, a depth of 100 feet reached, and 40 feet of drifting done in it.

SHOAL LAKE REGION.

More activity has been displayed in the Shoal Lake or Bag Bay region than during any previous year. During the winter of 1898-99 diamond drilling was in progress on several properties, followed by development work in the spring. A number of new locations, including water locations, have been taken up, and now all of Bag and Clytie bays are surveyed. Altogether about a dozen properties in the vicinity of the Mikado have been under development for the greater part of the summer and following winter, and a new five-stamp mill has been erected on one.

MIKADO MINE.

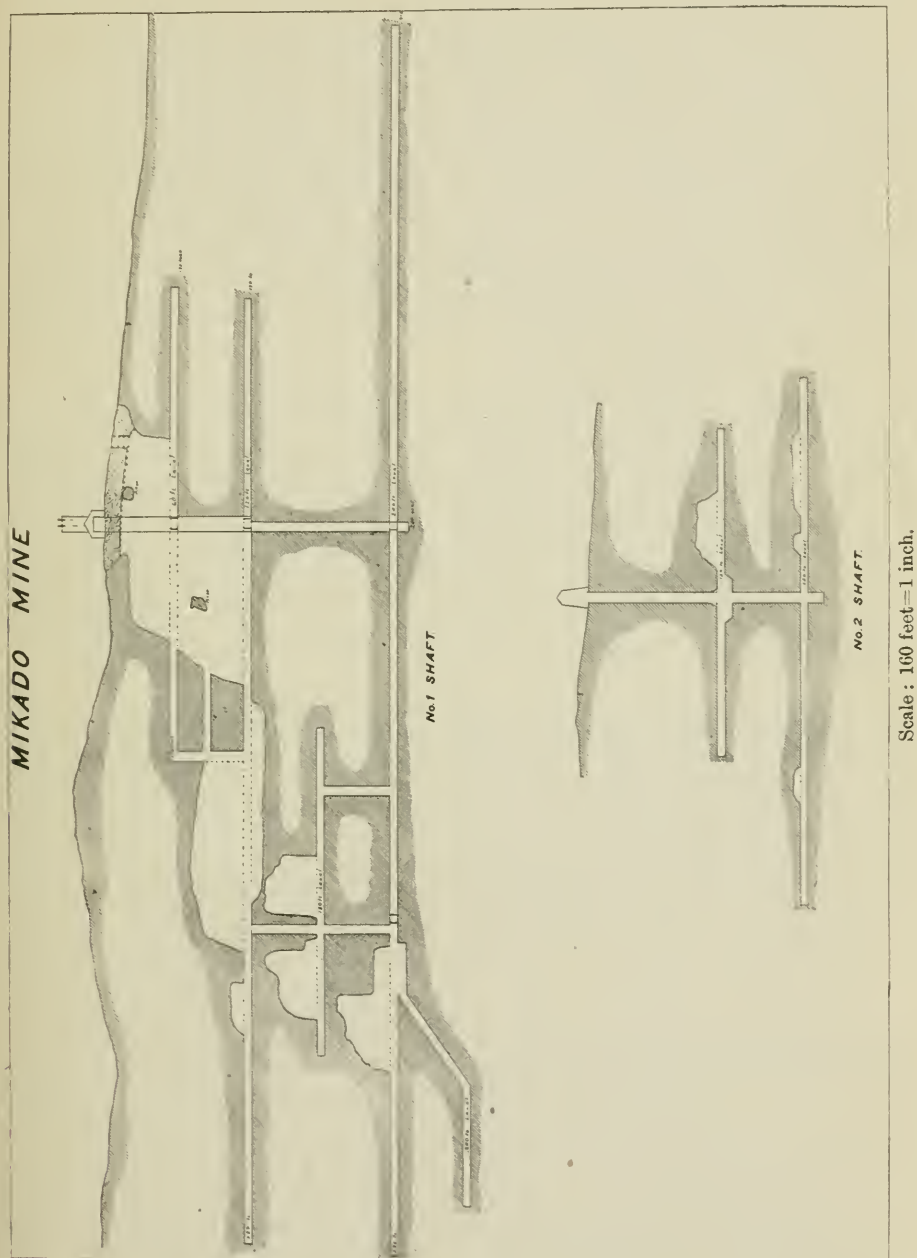
A general change was made in the management of the Mikado mine on March 10, 1899. Theodore Breidenbach, who had been manager since the commencement of operations, left the employ of the company on that date, and N. C. McMillan and F. C. Pengilly were appointed joint managers; Mr. McMillan being business manager and Mr. Pengilly superintendent of the mine and works. T. R. Deacon of Rat Portage was appointed Canadian director of the company, and to a certain extent has general superintendence over the affairs of the mine. Although the management of the mine is thus distributed among different heads, with no one person in absolute authority, matters progress quite smoothly and satisfactorily. Joseph Hicks is day captain of the mine and James McKenzie night captain. David John is battery and cyanide manager and assayer. There is a total force of 70, including 25 miners.

No. 2 shaft has been closed down since March 10, and is full of water. The hoist has been removed and the tramway to the mill pulled up. Operations may be resumed in this shaft in the spring of 1900, but not before. From the underground plan of this shaft I find that no further sinking has been done in the shaft, or no work in the first level. But additional drifting has been done in the second level; the north drift is now 178 feet in length, and the south drift 250 feet.

Operations have been confined exclusively to the main shaft and vein since the closing of No. 2. Stripping and test-pitting have been done at various points for a distance of about 1000 feet south of the shaft on the main vein. The first test pit is about 700 feet from the shaft, and 10 feet deep; the second about 100 feet farther south, and 5 feet deep. About 60 or 70 feet farther a costean has been made through the soil to bed rock, depth 8 feet, length 20 feet. About 150 feet farther the vein has been stripped for a few yards and shows branching; a test pit has been sunk 12 or 15 feet at this point. The continuation of the vein is thus proven for a considerable distance south of the shaft, and although surface showings are not remarkable they are encouraging, and a test drift will likely be run from one of the levels in the main shaft to prove the vein under the test pits.

The main shaft is 250 feet deep, no sinking having been done since last report, and with the exception of drifting at the 240 foot level no work has been done north of the shaft during the year. The north drift at this level has been driven 421 feet altogether and abandoned, the entrance being boarded over. It had been the intention to continue this drift to strike the contact with the granite at some distance to the north, where there was a probability of striking a good body of ore, but as this would involve nearly 1,000 feet more of drifting the attempt was given up. The workable portion of the Mikado vein occurs in a chute which has a dip of about 30° south, as described in the previous report; and as the chute lies nearly all to the south of the shaft the present operations are now confined to that direction.

No further drifting has been done in the first level since last report. The second level has been driven south 587 feet altogether, and discontinued. At a distance of 324 feet south of the shaft in this level a winze has been sunk through to the fourth, or 240 foot level. At a depth of 60 feet in this winze, or 180 feet from the surface, drifting has



been carried south 100 feet and north 162 feet, constituting the third level, which will eventually be connected with the main shaft. The fourth level has been driven south 553 feet. The first and second levels are connected by a winze at a distance of 180 feet from the shaft. At a distance of 200 feet from the main shaft in the fourth level a raise

has been made to connect with the third level. Some very cheap work in raising and sinking was done here; the winze between the 120 and 240 foot levels was sunk by contract at \$13 per foot, and the up-raise just mentioned was done for \$9 per foot. At a distance of 319 feet south of the shaft, in the 240 foot level, a crosscut has been driven west 62 feet and abandoned.

It had been believed at one time that the best part of the vein was at the surface and had been worked out, but the evidence of the fourth level does not substantiate this, and as far as appearances go the good ore might extend to any depth. The ore chute is of variable width and constitution. There are two walls which range from 2 or 3 to 10 or 12 feet apart. These are more or less definite; sometimes both are well defined, and at other places only one. The material between the walls consists usually of quartz or ore and barren rock, the latter occupying the centre and the quartz occurring as stringers on the walls, and sometimes in the centre. A considerable portion of the chute consists entirely of quartz between the walls. On account of the looseness of the walls all the rock between has to be broken out, no matter how far apart and how much is barren, and nearly all of this rock is sent to the surface as it would not be practicable to do sorting to any extent down below. And although a very satisfactory output of bullion is obtained monthly the manager, Mr. Pengilly, believes that it can be increased about 20 per cent. by the aid of a sorting plant which will remove most of the barren or very low grade rock. But this will be dealt with later.

The following stoping has been done since last report: Second level, first, or "No. 6" stope, length, 116 feet; height raised to first level; second, or "No. 5" stope, length, 144 feet, height above roof of drift, 40 feet; third stope, length 40 feet, height above roof of drift, 10 feet. At a height of 30 feet above the level, in the winze that connects with the level above, a drift has been driven connecting the first two stopes, in preparation for removing the block of ore between by underhand stoping. This block of ore is about 50 feet in length. An underhand stope has also been made in this level with the following dimensions: Length 125 feet, depth 12 feet, width about 3 feet. This has been filled with broken rock and a tramway laid over it. Third level: North drift, length of stope 56 feet, height above drift 34 feet. South drift, length of stope 70 feet height 36 feet. Fourth level: Length of stope 108 feet, average height 24 feet.

At the bottom level, where all the tramming is now being done, a distance of nearly 400 feet must be traversed to reach the shaft, as this much drifting through the barren part of the vein was necessary to reach the ore chute at this level on account of the chute dipping so flatly, and away from the shaft. There being only one tramway in the drift, it is with considerable difficulty that sufficient ore can be got out to keep the mill supplied, as all the ore in the upper level is sent to the fourth to be trammed to the shaft. Another thing, with the present vertical shaft each succeeding level requires a much greater amount of dead work to be done before reaching the ore, and this has become a serious question. So a new principle is now to be put into practice in the working of the mine. An inclined shaft, with a dip of 35° south, will be provided that will follow the main ore chute. The mouth of the shaft will be at the north end of the open cut west of the mill, and the shaft will follow the stoped out portion of the vein as far as that goes. Thus there will be no dead work with the exception of the shaft itself, provided the dip of the ore chute remains regular, and even if it does vary a little the amount of dead work will be small compared to the present method. The expense in constructing the incline from the surface to the present lowest workings will not be great, as so much of the excavation is already done. This will be a new principle in mining as far as this district is concerned, but will only be applicable to cases such as the Mikado where there is a flat-dipping ore chute, and the rest of the vein is not workable. Had there been any idea at the opening of the mine that the ore occurred as it does no doubt the method now about to be employed would have been originally adopted, and a great loss of time and money avoided. The present shaft cannot be used much longer anyway without re-timbering, as the present timbering is very poorly done and insecure. The new incline has been commenced in the 240 foot level at a distance of 381 feet from the shaft. A depth of 14 feet below the level was reached on Dec. 1, the date of my last inspection. Work in the new incline will be confined to sinking at present, and eventually the shaft will be completed above this to the surface, probably by the spring of 1900. A chamber about 14 feet cube has been excavated

in the level where the incline has been commenced for the installation of a subsidiary hoist.

A new steel wire hoisting cable one inch in diameter and 500 feet in length has been installed at the main shaft. An addition of 9 feet has been made to the dry and hoist house, and the hoist has been moved 15 feet further from the shaft. There is a small single-cylinder air hoist at the winze in the second level south. In sinking the winze a wire cable was employed to guide the bucket, instead of a skidway.

Some minor changes and additions have been made to the mill and cyanide plant. A new Blake crusher with 8 by 10 inch jaw opening has replaced the old one. In addition to the elevator a centrifugal pump has been provided for the elevation of the tailings to the charging tanks of the cyanide works. The elevator will be kept for emergency. Before the erection of the cyanide plant, the tailings from the mill being known to contain a considerable quantity of gold were dammed up at the lake so as to be accessible in the future. A tramway has been constructed from this tailings dump to the cyanide building, and a small hoist and tramcar employed for conveying the tailings to the latter place, where they are diluted and mixed with the fresh tailings from the mill and sent up to the charging vats. There is also 400 feet of tramway extending from the cyanide works to the waste tailings dump at the lake, and one tramcar employed for conveying the material.

An addition has been made to the mill building for the sorting plant, the machinery of which had been ordered and was on its way at the time of my last visit. The Jenckes Machine Co., of Sherbrooke, Quebec, are supplying the plant. The principle in the sorting consists of first dumping all ore on a grizzly. The fines go to the mill directly, and what passes over the grizzly falls on a horizontal belt and is carried along towards a bin at the end. A man stands at the belt and rakes off all barren pieces, i.e., pieces that contain no quartz. As stated before, Mr. Pengilly expects to increase the bullion output by about 20 per. cent. by this plant. At present the mine is paying handsomely, the output, about \$12,000 a month, being well maintained. Mr. Pengilly deserves considerable credit for the energy and ability which he has brought to bear in securing such a satisfactory state of affairs.

Previous to the past year Pennsylvania coal was burned in all the boilers at the mine. It was more expensive than wood, but more convenient. However wood has been burned this year, and will continue to be henceforth. A wood conveyor 400 feet long and capable of handling 10 cords per hour has been provided to take the wood from the barges and dump it on shore. A 6 by 6 inch vertical engine supplies the power. At the time of my last visit there were about 2,000 cords on hand, sufficient to last until the reopening of navigation, all wood being brought to the property by boat. A 40-light dynamo, with small vertical marine engine, is employed for lighting the mill and other surface works. A new dock with 50 feet of frontage has been built at a more convenient landing place. The old one is still used for passengers, etc. A building 20 by 30 feet in size for a general store has recently been constructed. A new Northey duplex pump has been installed at the second level in the mine, where a cistern 10 by 30 feet in area and 20 feet in depth has been excavated north of the crosscut from the main shaft. The main pump is stationed at the fourth level.

Instructions were left as follows :

- 1, Carefully scale the walls in all winzes and other parts of the mine, where men are apt to be passing through or working in.
- 2, Also, if the winzes are to be used for ascending and descending of men, construct a suitable ladderway in each ; and if they are to be used as ore chutes, also construct a suitable division.

During previous winters, owing to the two connections with the surface, viz., the main shaft and the stope or open-cut, the cold current of air naturally generated under such conditions caused the formation of considerable ice in the shaft as there was always more or less water dripping down, and the mine was also made too cold for the men to work in. So instructions had been left to cover the open cut over securely to shut off the air entirely in the winter, leaving an air shaft which can be opened in the summer time for ventilation. Accordingly a row of stulls was placed at a depth of about 15 feet below the surface, and the space above filled to the surface with broken rock. At one place tailings was put in, and this was found to shut off all surface water entirely, whereas at other places the water leaked in all along. Owing to the severity of winters in this

country it seems impossible to keep open two shafts which are connected underground, as cold underground air currents and the formation of ice in the ladder ways and drifts are difficulties that always result. However, an air shaft is usually not required in the winter time, and can be covered over. Suitable stalls are provided in all working stopes. The ore is shot down on these, and mill-holes are carried up through the broken ore for the discharge of it to the cars below.

Mr. Pengilly wrote me under date of Feb. 15 as follows: The incline winze, 8 by 7 feet, is down 110 feet and drifting is started. The vein at this depth is in the hanging wall, thus giving us a better chance for drifting north, as the drifting will not interfere with the shaft. We intend to sink another 100 feet after this month. The reef is five feet wide and gives good values. Everything indicates that the vein is widening with depth. I have much pleasure in stating that the main shoot is widening to the south. The total depth of the mine to date is 300 feet vertically. Drifting: (Recent work) Fourth level, south, 596 feet. Fifth level, south, 4 feet.

The sorting plant is now completed. The ore as it is raised from the mine is trammed to the grizzly, the coarse ore falling into a bin capable of holding 40 tons. The ore is then passed through an ore gate to a table which is made of flat iron bolted to a sprocket chain that travels at the rate of 20 feet per minute. The ore is then conveyed to a Dodge crusher with 7 by 10 inch opening. From there it falls into an elevator, by which it is raised to a chute, allowing it to fall by gravity into the mill. The whole plant is worked by a 16 h. p. horizontal engine. The waste rock is picked by hand off the table and conveyed to the waste dump. Water washing of the ore has not yet been adopted, although thorough provision is made for its use. The plant is capable of sorting out 50 tons per day if required; it works very satisfactorily.

SIRDAR MINE.

The Toronto and Western Mines Development Company, Limited, has named its property, which adjoins the Mikado and consists of location 410D, the "Sirdar," and location S182, which also belongs to this company and occupies the northern part of the peninsula west of Bag bay, is known as "Sirdar Point." The Sirdar is now owned by The Sirdar Mining Company, a subsidiary company with the same personnel as the preceding company.

Theodore Breidenbach, formerly of the Mikado, is general manager of the Sirdar properties, and O. R. Smith is superintendent of the Sirdar mine. At the time of my last visit, Nov. 30, there was a total force at both properties of 41, of whom 14 were miners.

The main shaft is 200 feet deep. At a depth of 100 feet a drift has been driven south 17 feet and discontinued. At a depth of 200 feet a 5 by 7 foot drift has been driven south 111 feet and is being continued. At a distance of 8 feet from the shaft in this drift a 5 by 7 foot crosscut has been driven west 75 feet and is being continued.

The veins consist, as stated in previous reports, of a zone of altered granite 3 or 4 feet in width, which coincide with planes of faulting in the eruptive granite formation of the Mikado peninsula. There is usually a small stringer of quartz in the plane of faulting, and small stringers are also occasionally found in the altered zone or vein matter. More or less pyrites is found in the latter and it is said to contain gold all through, but I think it will make only a low grade ore. The quartz in the plane of faulting is often very rich, considerable visible gold being sometimes found in it. There are several of these veins; the shaft and the main drift are on one, and the crosscut at the second level is being driven to cut others parallel. One of these has been passed through at a distance of 40 feet from the commencement of the crosscut.

A Northey pump is stationed in a chamber north of the shaft at the 200 foot level. The ladderway in the shaft is suitably constructed to within 60 or 70 feet of the bottom; below this it is only temporary, no divisions or platforms being provided. Instructions were left to remedy this defect. A suitable guard rail has been provided at the first level, and also at the shaft mouth.

A one-half duplex Ingersoll compressor of three-drill capacity has been installed, with three No. 3 drills. A new 40 h. p. locomotive boiler has been placed alongside of and connected with the present 25 h. p. one; an addition has been made to the boiler room for this. A compressor room was also built.

On Oct. 23 I visited the mine and found the hoist in a dangerous condition. The brake was useless, the bucket being held by a wooden block inserted between the gear wheels. Such a condition of affairs was of course intolerable, and instructions were given to have the brake replaced by one suitable for the purpose. This had been done on the occasion of my next visit. It was also recommended that a bell rope 3-16 inch in diameter be employed.

A dock with 150 feet of frontage has been constructed on Bag bay. The company owns the steamer Josie, which plies between the mine and Rat Portage.

SIDAR POINT.

At Sirdar Point a 5 by 9 foot vertical shaft has been sunk to a depth of 23 feet, and is being continued to strike an ore body which was located by the diamond drill at a depth of 67 feet. The shaft is neatly and substantially timbered to a depth of 12 feet; hoisting is done by derrick and horse-power hoist; four miners are employed. The diamond drill has been working all summer on different veins on this property with reported good results, and is still in operation. Boarding camps and other necessary buildings, including a manager's dwelling, have been erected, and a dock constructed.

BULLION NO. 2 MINE.

Adjoining the Mikado and Sirdar properties is the Bullion No. 2 mine, consisting of locations D233 and 389, reached by a half mile walk from the Mikado, and owned by the Bullion Mining Company of Ontario, Limited. President, D. O. Cameron, Rat Portage; manager, R. Rogers, Rat Portage; head office, Rat Portage. Wm. Smail is manager of the mine and John Harvey is mine captain. The total force at the time of my last visit, Dec. 1, was 20; number of miners, four.

Both trap and granite are included in the formation. There are three veins which exhibit distinct evidence of faulting, and are to a certain extent contact veins; two form a junction. All three are small but distinct. Felsite is associated with them to a certain extent.

Two shafts have been sunk 360 feet apart on different veins. No. 1 shaft is sunk a short distance from the junction. It has a cross-section of 5 by 7 feet, a dip of 70° northwest, and a depth of 75 feet. At a depth of 70 feet a drift has been driven south on the vein 22 feet. From the drift a crosscut has been driven west 53 feet, and from the end of the crosscut a drift has been driven 22 feet on a stringer. Hoisting is done by horse and whim, with bucket and pole skidway; the head frame is 11 feet high.

No. 2 shaft has the same dip and cross-section as No. 1; the depth is 112 feet. At a depth of 70 feet a drift has been driven south 10 feet on the vein. From the drift a crosscut has been driven west 50 feet, and from the end of the crosscut a drift has been driven south 15 feet. A diamond drill was in operation at the bottom of the shaft, boring east and west from the vein. A Lidgerwood reversible duplex hoist with 24 inch drum and $\frac{3}{4}$ inch steel wire cable has been installed. The bucket is dumped automatically at the surface. A neat head frame, 33 feet high, has been installed.

The drilling plant consists of a three-drill Ingersoll straight line compressor, a 3 by 6 foot receiver, and two No. 3 drills. The boiler is of 50 h. p. locomotive style; the engine and boiler house is 30 feet square. A short tramway and car are provided at the surface. The buildings consist of boarding and sleeping camps, storehouse, office, powder house, engine and boiler house, blacksmith shop and stables. The timbering of the shafts at the surface is neatly and suitably done. A ladder has been constructed in each shaft, but no division or platforms are provided with the exception of a short distance from the surface. Instructions were left to have this matter attended to, and also to provide a suitable guard rail at the mouth of each shaft.

Shortly after my last inspection Charles Brent of Rat Portage succeeded Mr. Smail as manager.

IMPERIAL MINE.

The Imperial mine, situated about a mile southeast of the Mikado, consists of location D397, containing 54 acres. The regular landing is at the east end of Helldiver bay, from which a road of a half mile in length extends to the mine. A two-mile foot

trail connects the property with the Mikado. The owner is H. C. Symmes of Niagara Falls, Ont. Operations have been in progress since May 15, 1899. A. A. Hare is manager of the mine. The total force is 10, including eight miners.

The formation is trap. There are said to be five parallel veins within a distance of 110 or 120 feet; these are simply zones of quartz and greenstone, mixed; the quartz occurring in small stringers, and sometimes forming a definite vein.

A 5 by 8 foot shaft has been sunk on one vein to a depth of 70 feet. At a depth of 65 feet crosscuts have been driven north and south 9 feet each way and are being continued to cut the other veins. Hoisting is done by horse power, with a Colorado whim; a bucket is employed sliding on a pole skidway. The shaft is timbered for a depth of 23 feet; a ladder way extends to the bottom, but is not divided off from the hoisting compartment or provided with platforms as required by the Mines Act. Instructions were given to have this done. The shaft mouth is suitably fenced.

There is an old shaft about 50 feet east of the main one, on the same vein. It is said to be 50 feet deep, but is full of water. A number of small test pits have also been sunk on the property. The buildings consist of boarding camps, office, stables, shaft house, blacksmith shop and store house.

YUM-YUM MINE.

Two miners have been employed all summer doing exploratory work on the Indian Joe vein on the Yum-Yum property. I visited the property on Nov. 30, and saw a test shaft which had been sunk to a depth of 45 feet and discontinued. Another shaft was just commenced at a point where a small rich stringer of quartz was contained in the felsite. H. A. Guess is in charge of the work; Wm. Gordon is foreman. Mr. Guess informed me on Feb. 6 that the force had been increased to five.

LOCATION M 11.

On Nov 30 I visited M11, a location containing nearly 100 acres, and situated on the northwest shore of Helldiver bay. It belongs to Silas Griffis of Rat Portage, and has been bonded to J. B. Campbell of Montreal. T. R. Deacon of Rat Portage is superintending the sinking on two 50 foot shafts on the property. One shaft is being sunk close to the water on a 12 inch quartz vein containing iron pyrites and pyrrhotite. The walls are well defined and contain selvage. The country rock is altered trap; next to the walls it is schistose. The depth of the shaft is 12 feet and the cross section 6 by 8 feet. The other shaft is about half a mile north and is being sunk on a felsite dike which contains a vein of quartz mixed with the felsite to a certain extent, and ranging in width from 2 or 3 to 24 inches. This shaft is of the same depth and cross section. About 200 yards south of the preceding two costeans have been made across the dike, revealing a large body of quartz and felsite, mixed and considerably altered; copper and iron pyrites occur. The force consists of four miners; the work is done by contract.

TYCOON MINE.

The Tycoon mine is situated about three-quarters of a mile directly north of the Mikado, and the property consists of three small islands, D219, 221 and 222, and water location JES54, circumscribing the islands. The owner is the Tycoon Mining and Development Company of Ontario, Limited; head office, Rat Portage. President, James Conmee, M.P.P., Port Arthur; secretary, M. Kyle, Rat Portage.

The formation of the islands is granite. There are no vein outcroppings, but the extension of the Mikado No. 2 vein is supposed to be on this property. Diamond drilling had been going on during the summer and winter previous to the commencement of sinking. Several bores had been made; and according to the report of Mr. T. Breidenbach, who superintended the drilling, very satisfactory results were obtained.

A vertical shaft is being sunk on one of the islands, D219, to reach the ore body. It is $5\frac{1}{2}$ by $8\frac{2}{3}$ feet in cross section, and at the time of my last visit, Dec. 1, was said to be 78 feet deep. Work was suspended awaiting the arrival of a steam hoisting plant; so far windlass and bucket had been employed. A suitable ladderway has been constructed; but it is not divided off from the hoisting compartment. The shaft is timbered for a depth of 17 feet; the shaft mouth is suitably fenced.

P. S. Griffin is manager of the mine, and J. Downey is foreman. Buildings consist of boarding house, shaft and hoist house and blacksmith shop.

CROWN POINT MINE.

During the past summer operations have been carried on vigorously at the Crown Point mine, which is situated on the point east of the narrows between Bag bay and Clytie bay. The property consists of location D258, containing 106 acres. It is owned by the Crown Point Mining Company, Limited, with head office at 44 Canada Life, Montreal; capitalization, \$1 000,000 in one dollar shares. President, Robert Bickerdike, Montreal; vice-president and managing director, R. H. Ahn, Rat Portage; secretary, E. A. Barton, Montreal.

The formation of the property is eruptive granite and altered trap. There are two classes of ore bodies; one consists of a large reef about 100 feet in width, situated at the contact between the granite and the greenstone; it is composed of altered granite and greenstone mixed. The structure is almost felsitic in parts. Small stringers of quartz occur, and the deposit is more or less charged with pyrites. Stripping and blasting have been done over the entire width at one point, and it is said that encouraging values were obtained. A shaft 8 by 16 feet in cross section had been sunk to a depth of 23 feet at the time of my visit, Dec. 1, and was being continued. A derrick and a horse power whim were employed for hoisting.

The other ore bodies, or veins as they are called, consist of sheared zones in the granite, similar to those of the Sirdar. Small stringers of quartz occur in the altered material, and visible gold is said to be found in them.

The main vein has a strike of a few degrees south of east. Two shafts are being sunk 200 feet apart on it. The main shaft is 8 by 16 feet in cross section, and is said to be 70 feet deep, with a cross cut at the bottom, 15 feet east; but it was full of water at the time of my visit, as the steam hoisting plant was being installed. There are two hoisting compartments and a ladder way. The shaft is neatly and substantially timbered with square timber that is said to extend to a depth of 30 feet. The head frame is 35 feet high, suitably braced and neatly constructed. The engine-house is nearly completed, the boiler and hoist being in place. The other shaft, known as the air shaft or "winze," is east of the main shaft, and sufficiently elevated to insure proper ventilation when underground connection is made. The cross section is $3\frac{1}{2}$ by 10 feet, with neat collar; the depth is 47 feet, and sinking is being continued with windlass and bucket. There is a plane of faulting crossing the main vein about 100 feet west of the main shaft, and which is claimed to be an extension of the Mikado No. 2 vein. A test pit has been sunk 8 feet on it. A five-stamp mill is being erected on the northwest side of the point at a convenient situation with regard to the shafts. At the time of my visit all the machinery was on the premises, the building was completed and the boiler-house in course of erection. It is only intended as a test mill, as a plant of 100 stamps is in contemplation in the near future. Buildings consist of: Mill building, hoist house, blacksmith shop, powder house, boarding camps and private residence. There is a total force of 36, including 20 miners. W. Sharp is mine captain.

Mr. Ahn informed me that his company had altogether 23 locations in different parts of the district, and that for this property alone \$15,000 had been arranged for as development funds.

He is also manager of the Gold Reef's Company, Limited, with the same head office as the preceding company. This company owns 26 locations in different parts of the district, and are developing at two different places; the Victory mine, consisting of locations McA41 and S48, east of Witch bay, on which a shaft has been sunk 25 feet and is being continued; and Gold Reefs No. 2, consisting of three locations in Clytie bay. A shaft has been sunk 10 feet on this property.

GREAT GRANITE PROPERTIES.

Operations were continued during the year on the property of the Great Granite Gold Mining and Development Company of Ontario, Limited. As stated in last year's report, this company owns 5,000 acres south of Echo bay, and prospecting operations have been in progress for about a year and a half on it. This past summer locations

northeast of the Crown Point mine were being prospected. The contact between the granite and the trap extends in a southwesterly direction through their property, occurring in a gully almost entirely hidden by swamp. Work has been principally confined to prospecting this contact. Stripping and test-pitting have been done along the sides of the gully, where the rock was elevated and samples assayed wherever anything suggestive of an ore deposit was found. At the time of my visit, Oct. 12, a test pit had been commenced on the side of this gully where a stringer of quartz was exposed. It was of course inadvisable to make any serious attempt to get at the contact through the swamp, and the company intended to do any further testing or prospecting with the diamond drill.

The superintendent of the work is S. H. Reynolds; assayer, B. L. Thorne. Six miners had been employed all season, but there were only three at the time of my visit. The camps are on Clytie bay. These consist of tents on shore for the men, and a house-boat which served as general boarding camp, dwelling for manager and assayer, general office and assay office. The house-boat is an innovation for this purpose, and, although a little more costly than rough camps on shore, is more comfortable and can be moved from place to place according as the scene of operations change. It can be recommended to parties who intend doing prospecting work on a small scale on almost any property on the Lake of the Woods, or other body of water which gives access to a number of properties. In case of the abandonment of the property the house-boat, being movable, is not a useless asset as fixed camps usually are.

CAMERON ISLAND MINE.

After nearly a year of idleness, operations have been resumed at the Cameron Island mine since the latter part of the summer. The company has been reorganized, although no change has been made in the name. The present officers are: President, Dr. Joseph Fowler, Buffalo; vice president, Thos. Milburn, Toronto; secretary, Harry Vars, Buffalo; treasurer, H. J. Brain; head office, Toronto. The manager of the mine is A. D. Lord, and the foreman Geo. Thurber. As mining operations had not commenced at the time of my inspection, Oct. 11, the force consisted of only a few men employed in surface work. A one-half duplex Ingersoll air-compressor of three drill capacity has been installed, with three machine drills, a receiver and 40 feet of 3-inch conductor pipe. A new 80 h.p. return tubular boiler has been placed along side of and connected with the previous one of 25 h.p. New frame buildings have been erected, consisting of the following: Engine- and boiler-house, 40 by 40 feet; foreman's dwelling and office, manager's dwelling and general office, assay office and carpenter shop. The latter is provided with a 6 h.p. engine for operating the machinery therein. An addition has been made to the dock on the south side of the island, giving it a frontage of 60 feet.

NORA MINE.

On Oct. 20 I visited the Nora mine, which consists of locations JES38, 41, 42 and west half of 39 and JO79 and 80, aggregating about 200 acres. It is situated in the northern part of the Western peninsula, Lake of the Woods. The steamboat landing is at the foot of a small bay on the south shore of Ptarmigan bay, and about 15 miles from Rat Portage. There is a good portage of about 200 yards into Fox lake, over which a canoe trip of $1\frac{1}{2}$ miles must be made to the mine landing, which is connected with the mine by a road $1\frac{1}{2}$ miles in length. The property is owned by The Gold Leaf Mining Company, Limited; and the head office is 32 Ontario Chambers, Ottawa. President, Hon. Dr. F. W. Borden; vice president, Hon. Senator Clemow; sec-treasurer, A. Simpson; managing director, A. T. Mohr, 812 Prudential Building, Buffalo, N. Y. Robert Laird, M.E., is manager of the mine, and Ed. Hamill is mine captain. The total force is 17, of whom 10 are miners. The formation is trap. Large granite dikes, merging into porphyry at the sides, occur at several places on the property. Stripping and test-pitting have been done on some of these, where veins or stringers of quartz occur. The main vein occurs in a dike of felsite, or fine grained granite, which has a strike of north 70° east. It is traceable in this dike over adjoining locations in both directions, and it is said to extend for miles.

On location JES38 a shaft with a dip of 79° north has been sunk on the vein to a depth of 120 feet and is being continued. The cross section at the surface is 4 by 7

feet, and lower down 6 by 10 feet. At a depth of 72 feet the vein appears to split ; one branch bending to the north, with a dip of 45° , and the other continuing straight. The north branch was followed for 25 feet by an incline, showing a good hanging wall with selvage. The vein in this incline is well defined. The shaft had subsequently been continued on the other branch, maintaining the same dip as above. The width of the vein underground ranges from 1 to 4 feet. The first level is at a depth of 72 feet ; a 4 by 7 foot drift has been driven east 49 feet. The pump, a Northey, size 5 x 7 x 12, is stationed at a depth of 90 feet, in a chamber at the entrance to the incline, and the latter is used as a cistern.

The hoisting plant consists of double drum duplex Waterous hoist, 25 h. p., return tubular boiler, steel wire cable, bucket, pole skidway and a head frame 30 feet high, substantially constructed. There is 100 feet of tramway on the surface, with one iron self-dumping car. Smoke and gases resulting from blasting are cleared out of the shaft by live steam. The shaft timbering extends for a depth of 45 feet on the ends and hanging wall, and for 30 feet on the foot wall. The mouth of the shaft is properly fenced, and provided with inclined trap doors, which are closed when dumping. A ladderway has been constructed to the required depth, and is in suitable condition, with the exception that it is not divided off from the hoisting compartment. Instructions were given to have this done. Blasting is done by battery in the shaft and by fuse in the drifts. The following buildings are on the property : Cooking and sleeping camps, blacksmith shop, engine house, 24 by 24 feet, powder house and stable.

On the adjoining location to the east, which does not belong to the company, a shaft said to be 30 feet deep, but partly full of water, has been sunk on the vein or dike at a distance of 600 feet from the Nora shaft.

MANITOU LAKE REGION

It seems strange that the Manitou country has not been more successful in securing its share of the progress of the district in the past. It is not so accessible as the Lake of the Woods, but is more so than some parts of the district which are going ahead favorably. There is a regular steamboat service on Wabigoon and on Manitou lakes ; three steamers on Wabigoon lake and two on the Manitou. There is also a stage (an ordinary wagon) on the seven-mile portage. The road is usually in fairly good condition if the season is not wet. Probably the fact that stamp mills are coming in will make a difference, and give an impetus to mining in this region. Comparatively little work was going on early in the summer, but later several new properties were put under development, and prospects for a good future were much improved. There is a formation of felsitic schist, which occurs in the green schist, and appears to extend all down the Manitou. It is more or less filled with stringers of quartz in varying quantities, and in some places quartz veins of fair size occur. Most of the working mines are in this formation, which apparently carries gold all through, the richest portions being the places most heavily impregnated with quartz. From all appearances the Manitou will prove to be a region of large low-grade propositions.

OXFORD MINE.

The Oxford mine consists of locations SV128, 129, 131 and 166, situated about a mile west of Gold Rock on the Upper Manitou. The property is owned by Messrs. Thos. Armstrong, Wm. Pinkerton and Wentworth Sharp ; and it is under operation by the Oxford Mining Company of Toronto, Limited, who get a certain interest for the expenditure of a certain sum on development work. The president is Wm. Pinkerton ; secretary, John F. Gray ; head office, 80 Bay street, Toronto. Thos. Armstrong is manager of the mine ; total force, nine ; number of miners, four. The formation is green schist. The ore body is a reef consisting of the schist filled with stringers of quartz. On SV129 a shaft 6 by 8 feet in size has been sunk 77 feet in the centre of the reef, with crosscutting at the bottom north and south 13 and 11 feet respectively. Date of last inspection, Oct. 6. Buildings consist of boarding camps, blacksmith shop and stables.

ORION MINE.

On Oct. 8 I visited the Orion mine, on my return trip up the lakes. This property is situated southwest of Charlton lake, which is west of the narrows between the Upper and Lower Manitou lakes. It consists of seven locations, HP357, HW88, 49, 50 and 51 and G151 and 460; owned by the Orion Gold Mining Company, Limited, of Rat Portage, Ont., capital, \$999,999, in one dollar shares; head office, Rat Portage, Ont.; branch office, 318 and 319 Germania Life Building, St. Paul, Minn. Geo. H. Fallerton of Rat Portage was president, and H. O. Peterson of St. Paul secretary at the time of my inspection; but I was told by the president that the company was to be reorganized and the new officers were not appointed at the time of writing. The ore body consists of a band of schist which is more or less filled with stringers of quartz. In some places the schist is quite heavily impregnated with quartz; these are the richest portions. What is called the vein or pay streak is a zone of the schist filled with quartz stringers. The strike of the schist is northeast and southwest. A shaft 6 by 10 feet in size, with a dip of 60° to 70° southeast, has been sunk on the vein to a depth of 50 feet, and is being continued. The work is being done under contract by Alex. Gordon; three miners are employed. Newton Higbee, the vice-president of the company, is manager of the mine. The only building is a board-and-batten camp.

INDEPENDENCE MINE.

The Independence mine, mentioned in last year's report as the "Westerfield" mine is the adjoining property to the Orion. Operations were suspended at the time of my visit, owing I believe to a lawsuit which had been pending for some time regarding the title to the property. No work had been done in shafts No. 1 and 2 since last year's report. The main shaft, on No. 3, was also partially full of water, preventing ingress. But Mr. Gordon, who had been in charge previous to the suspension of operations, informed me that a depth of 85 feet had been reached, and that a crosscut at the bottom passed through a width of 38 feet of ore. The mine will likely be in operation again soon. All the machinery for a 10-stamp mill was on the road between the railway and the mine. The greater part was at the mine landing, which is on the south shore of Little Manitou lake, from which point a good wagon road extends to the mine.

GLASS REEF.

The Glass Reef property consists of locations HW391 and 594, containing 40 acres each, situated on the mainland south of Beaverhead island on the Big Manitou lake. It is owned by Messrs. Geo. W. Glass, E. H. James and A. P. Buchanan, who are organizing into a company to be called the Glass Reef Gold Mining Company of Manitou Lake, Limited, with a capital of \$750,000; par value of shares, 50 cents.

The ore body is a large reef of fine grained schist, which weathers grayish white, and in some places reddish brown, due to pyrites. Granite occurs on the west side of the reef, and trap on the east. The reef contains stringers of quartz, and in some places quartz veins, and is full of latent cracks and seams. A shaft 6 by 12 feet in size has been sunk to a depth of 14 feet on the reef and is being continued. Hoisting was done by horse power at the time of my visit, but a steam hoist was on the way and will be installed at once. An air compressor is also on the way. Camps are being erected. The total force is 14; number of mines, 12. Geo. W. Glass is manager and James McGillivray foreman. Date of inspection, Oct. 7.

ADJOINING LOCATIONS TO GLASS REEF.

I walked over to HP267, an adjoining location, said to belong to V. Quackenbush, and found the continuation of the reef, with an 8 foot test pit, in which sinking was in progress. On HW595, another 40 acre location adjoining on the west, a test pit had been sunk 15 feet on a large out cropping of quartz, which has the appearance of a vein lying almost flat, and about 10 or 12 feet in thickness. The country rock is massive greenstone. The location is owned by Messrs. Glass, McGillivray, Buchanan and James.

BARKERS' MINE.

Barker Bros.' mine consists of location HW339, situated northwest of the Lowe Manitou lake. The landing is near the upper end of the long bay which extends north from the southwestern part of the lake. The mine has not been in operation since early in 1899, and there was only a caretaker on the property at the time of my visit. The formation is greenstone. Small irregular veins of quartz extend through the property. A shaft had been sunk to a depth, said to be 62 feet, with drifting at the bottom and overhand stoping, but it was full of water. At a short distance from the shaft an open cut had been made along the vein 100 feet long, 3 feet wide and about 4 feet deep. Stripping and blasting had been done at other points also. The shaft is about a mile from the lake, where a Tremaine two stamp mill has been erected, which was in operation for some months during the winter previous to closing. The other machinery consists of a Gates crusher, a horizontal engine for the crusher and a return tubular boiler. A wagon road has been constructed from the shaft to the mill. Boarding camps and other buildings have been erected.

LOCATIONS BEYOND BARKERS' MINE.

About two miles beyond Barkers' mine is HW515, a location of 118 acres owned by Messrs. D. C. Petrie, A. H. Oreighton and H. E. Price. An open crosscut 8 feet deep was being made through an outcropping of quartz 24 feet wide in a formation of greenstone. Other veins were observed on the property, on which a little work has been done. A 2 foot vein of promising looking quartz was observed in a band of felsite schist. Camps were being erected on the property. The total force was nine; number of miners, six.

CRACKER JACK MINE.

The Cracker Jack mine is situated on the south shore of the long arm (known as the "Manitou Stretch") of the Lower Manitou lake, about 10 miles from the main body. It is owned by the Cracker Jack Gold Mining Company, Limited. Walter J. Keating of Fort Francis was manager of the mine while it was in operation, which was for a few months during the summer. The formation is a fine grained schist, which weathers white and brown. The veins consist of zones impregnated with stringers of quartz. I walked over the property alone, as no one was there at the time of my visit, Oct. 7, and found two shafts 40 and 45 feet deep on different veins. Mr. Keating informed me in writing that a third had been sunk 19 feet.

NEW KLONDIKE REGION.

Comparatively little work has been going on in the New Klondike during the year. Most of the property owners are either waiting to sell, or else waiting the results of development work on properties in actual operation, before deciding upon the expenditure of money upon their own.

Early in the year I visited NT20, a location about 12 miles north of Dymont, for the purpose of investigating an accident which occurred there on March 28, 1899. A vertical shaft has been sunk 80 feet in the hanging wall of a large quartz vein. Work was discontinued later on in the season.

A little prospecting work was done on several other properties in this region, but they were not visited. Thos. Hogan informed me that he sunk 17 feet on location H W 434, belonging to him on Long lake. The vein looked very well, was of considerable width and gave encouraging assays.

Two properties were being worked near Tache on the O. P. R., but I did not visit them. I was told a shaft had been sunk 80 feet on one of them.

GOLDEN WHALE MINE.

Munroe and Wa'son's mine, HW416 in the New Klondike, is now known as the Golden Whale. This property has been in steady operation during the year. Three

shafts have been sunk, but only one was in operation at the time of my inspection, Feb. 17. I got the following measurements from the manager, in connection with No. 1 and No. 2 shafts, which were full of water: No. 1 shaft, depth 105 feet; crosscut at bottom, 15 feet southeast. No. 2 shaft, 470 feet north east of No. 1, on a different vein, depth, 105 feet; at depth of 60 feet a crosscut 5 feet northwest. No. 3 shaft is 200 feet southwest of No. 1 on the same vein. The depth is 80 feet. At a depth of 75 feet there is 29 feet of drifting in each direction along the vein, which ranges in width from 1 to 4 feet in the drifts. The ladderway consists of ladders suspended from the surface, without any division or platforms. Instructions were given to remedy these defects, and also to fence this and the other two shafts. The hoisting plant consists of a small steam hoist, vertical boiler, wire cable, bucket and pole skidway. Each shaft is provided with a suitable head frame.

There is an open cut on the main vein extending northeast from No. 3 shaft for a distance of about 500 feet, with an average depth of about 7 feet. Instructions were given to fence or fill the open cut. At a distance of half a mile from the shaft a mill has been erected on the bank of a small river and the following machinery installed: A Tremaine two-stamp mill, with apron plate and gyrating amalgam plate, a No. 1 Gates crusher, Frue vanner with 6 foot belt, 35 h.p. boiler, 16 h.p. engine and pump. The buildings on the property consist of mill building, temporary hoist house and blacksmith shop, store house, boarding camp, stables, manager's dwelling and two private dwellings. The manager of the mine is John M. Munroe; mine contractor, Thos. Hogan; number of miners, 10; total force, 21.

LOCATION SV105.

Two or three properties in the Lake Minnetakie region north of Dinorwic have been worked to a small extent during the summer. I did not visit this locality, but got some notes from parties operating there.

Location SV105, known as the Sykes mine, is the most extensively worked property. It was originally owned and operated by a syndicate from eastern Ontario, but the syndicate have formed into a company, the John Sykes Mining and Milling Company, Limited; capital, \$500,000 in one dollar shares; head office, McKinnon Building, Toronto. President, John Sykes, Glen Williams, Ont.; vice-president, John Shilton; secretary, W. H. Wallbridge. Work has been going on at the mine since the winter of 1897-98. I was informed by G. H. Fanning, the manager, that the shaft had been sunk to a depth of 108 feet. At a depth of 57 feet a crosscut has been driven east 14 feet, and one west 21 feet. At the bottom of the shaft a crosscut has been driven east 42 feet and one west 70 feet. The machinery for a 10 stamp mill is on the property, and partially set up. A total force of 12, including 8 miners, was employed while the mine was in operation. On Feb. 12 two miners were killed by an explosion in a test pit about 300 feet from the main shaft, and work was suspended with the probability of not being resumed for some time.

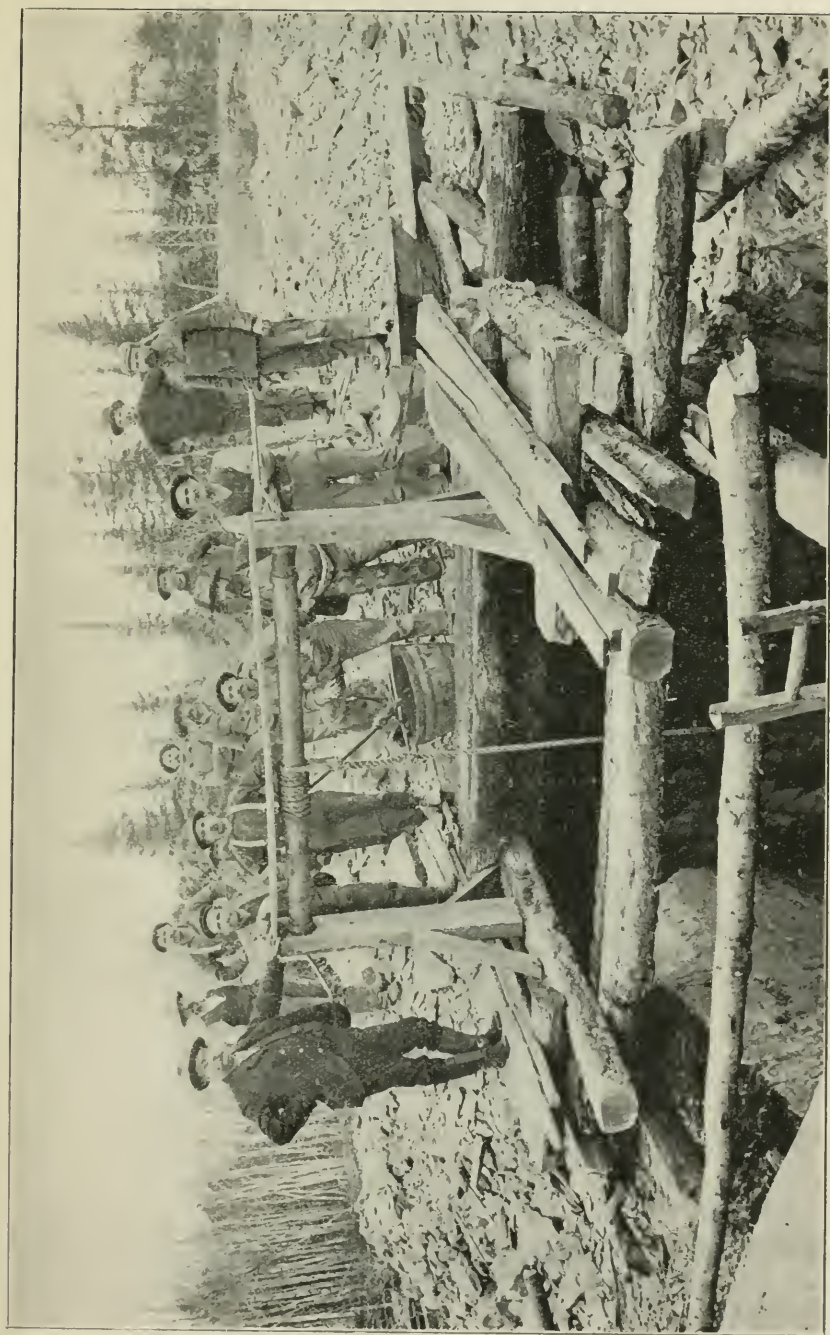
OTHER MINNIETAKIE PROPERTIES.

Mr. D. W. Black of Dinorwic has been manager of several properties in the Lake Minnetakie region during the year; and he gave me the following notes on them:

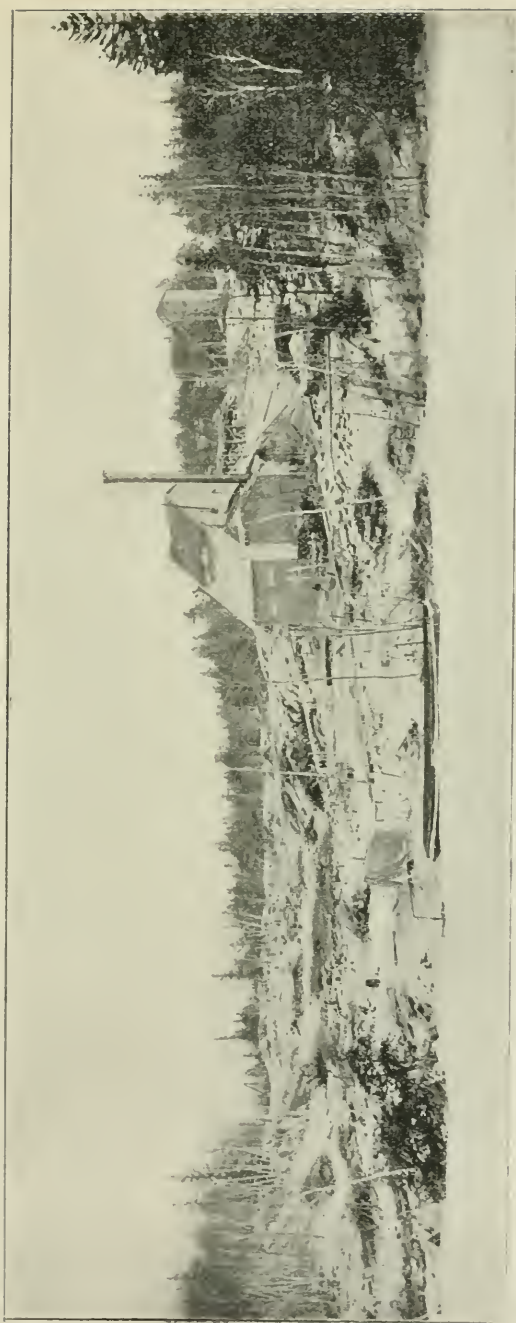
Location HW113; area, 40 acres; situated on east shore of Pelican lake; owners, a syndicate composed of Toronto capitalists. Work had been going on for 2½ months during the fall of 1899. Five miners were employed test-pitting. The Golden Rod Mining Company of New York sunk a 40 foot shaft on a location on Teresa lake southeast of Minnetakie.

LOWER SEINE REGION.

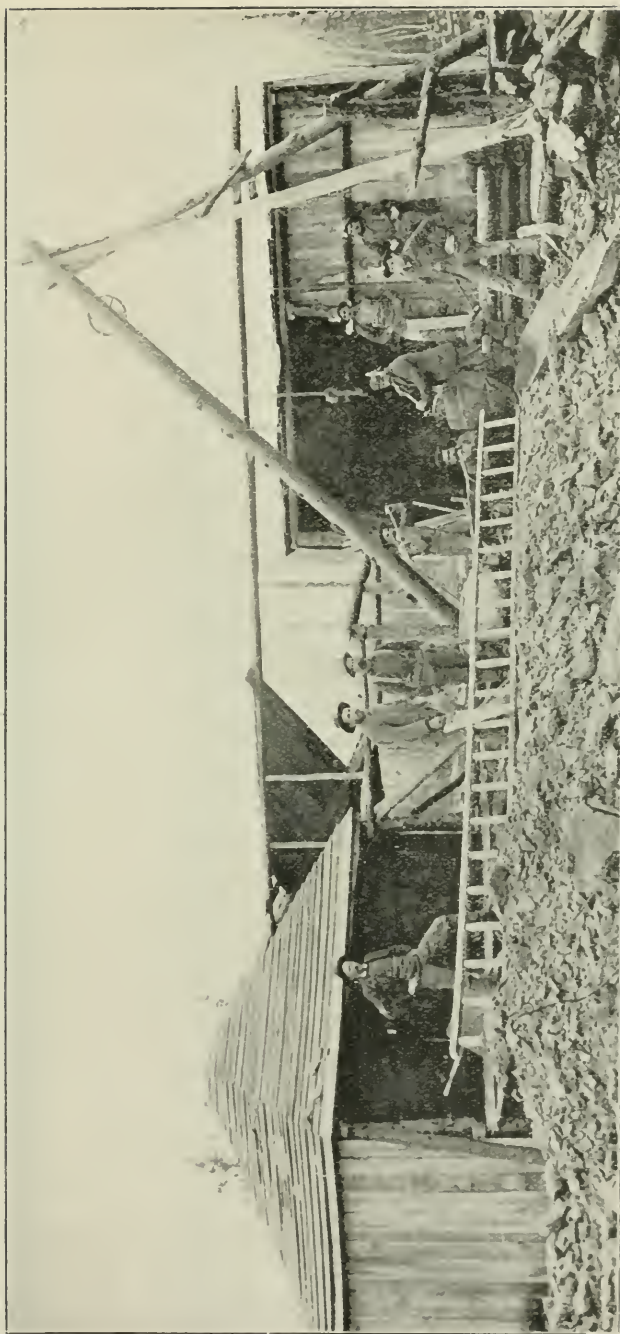
Notwithstanding the disastrous effect upon the mining market of the uncertainty regarding the Golden Star, splendid progress has been made in this locality during the year. About a dozen properties have been under substantial development for the greater



17. Main Shaft of Crown Point Gold Mine, before Shaft House was erected, p. 59.



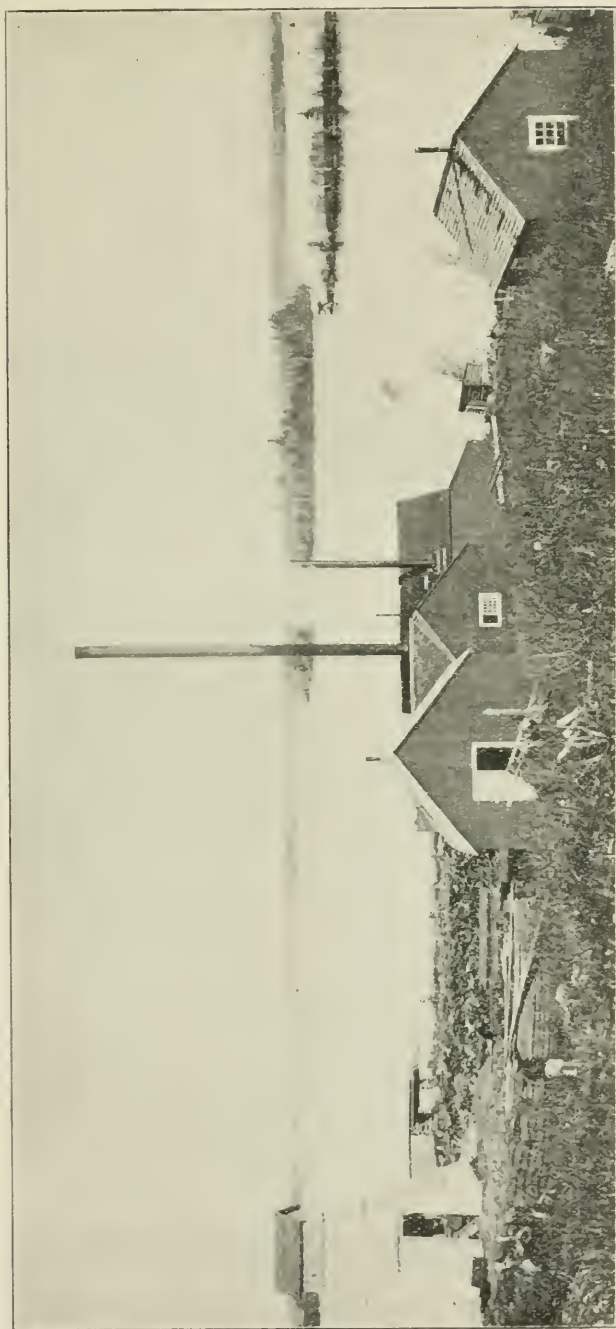
18. Mill Shaft House, etc., of Crown Point Gold Mine, p. 29.



19. Imperial Gold Mine, Shosh Lake, p. 57.



20. Cameron Island Gold Mine, p. 60.



21. Shaft and Engine Houses of Cameron Island Gold Mine, p. 61.

part of the time, and in most cases by genuine companies who are not working for mere speculative purposes. It appears that a more substantial class of men who have

FOLEY MINE



Scale : 90 feet = 1 inch.

money to spend are now recognizing the possibilities of the district, and are doing legitimate development work accordingly.

FOLEY MINE.

There have been continual reports of the sale and the reopening of the Foley mine ever since its closing down of May 20, 1898. It has at last been sold, and hearing that work was to be commenced I wrote to Mr. O. B. Robinson, the manager of the mine, and received a letter from him under date of Feb. 13. The new company is the Canadian Mines Development Company, Limited; head office, St. Stephen Chamber, Telegraph Street, London, England. The force will not exceed 20 at present. Work will be commenced in No. 5 shaft, sinking, drifting and crosscutting to develop the ore body. Work was to have started in about 10 days from the date of the letter.

GOLDEN STAR MINE.

The Golden Star mine has been the central figure among western Ontario mines during the past year and for some time previous. The geology of this mine has been sufficiently dealt with in previous reports, and hence need not be gone into here. Before any work was done on the property there was little showing to encourage the expenditure of money. It is said to have been condemned by several experts who examined it. However Mr. Lewis A. Hall, a wealthy American mining man, owned a large number of shares in the company, and supplied the capital to develop the property and erect a mill. Results were not very encouraging until after the first level was passed, which is at a depth of 75 feet. Prospects brightened from then on, and the property looked well. The shaft was sunk to a depth of 376 feet, and four levels established with an aggregate of about 700 feet of drifting. These developments revealed a rich chute of ore about 100 feet in length and from 2 to 12 feet in width, extending through all the workings from the surface down. Systematic assay work showed where the best ore lay. A 10 stamp mill was erected, hoisting and tramping plants installed, and development work in the mine suspended. The history of the mine and the company from this on is evidence of the policy which the American owners had deliberated and successfully carried out. Under the belief that the best ore had pinched out at the bottom, and that hence the end of the mine was in sight, they proceeded to bull the price of the stock with a view to unloading to the best advantage. Accordingly, development work in the mine was practically discontinued at this stage. The company had then to start with, a developed mine, all the ore being blocked out but none stoped, a large dump of ore on the surface resulting from development work, a well-equipped mill and an economical tramway between the mine and the mill. Expenses were cut down in every possible way, the best ore taken from the mine and the dump, and thus a large bullion output secured at a minimum of expense. When Mr. Hall advanced the original money to develop and equip the mine an agreement was made by which he was to be repaid by the first products of the mill. Instead of taking payment in this way Mr. Hall allowed the product to go towards paying dividends, and was remunerated by receiving additional stock, which was increased from 1,000,000 to 1,200,000 shares, the increase going to Mr. Hall. Before the stock was increased monthly dividends of 1 per cent. were declared until the stock had risen to what was considered the maximum, which was a little over 80 cents, the par value being one dollar. The stock fluctuated between 70 and 80 cents for some time, and the largest shareholders were at this time unloading, as the mine had been gutted of its best ore. Toronto capitalists bought in (the stock having been originally held almost entirely in the United States) until they obtained a controlling interest. The head office was then moved from Duluth to Toronto, and the company was reorganized. The officers at present are as follows: President, Hon. S. C. Wood; secretary, N. C. Neff; treasurer, H. H. Wood. As the mine had been despoiled of its best ore, and there was no development work ahead, the company could not continue to pay dividends, so they bent their energies towards developing the mine and placing it in condition for permanent work. R. A. Kerr, the superintendent of the mine, resigned, and R. H. Flaherty, who has been for several years connected with mining in western Ontario, was appointed manager in July, 1899. Development work was delayed for some time after Mr. Flaherty's appointment, pending the arrival of auxiliary hoisting machinery for sinking in the main shaft. However this arrived early in August, and from that time development work has been pushed continuously. The following were the underground measurements at the time of my last inspection, Oct. 29:

		feet.
First level.....	North drift	107
	South "	101
Second level.....	North "	144
	South "	131
Third level.....	North "	149½
	South "	46½
Fourth level.....	North "	207
	South "	14
Fifth level.....	North "	39
	South "	26
Sixth level.....	North "	36½
	South "	35½

The fifth level was driven at a depth of 357 feet and the sixth at a depth of 430 feet.

Winzes and upraises : At a distance of 100 feet north of the shaft a winze connects the first and second levels. An inclined raise has been made from the end of the fifth north to the fourth, breaking through to the latter level at a distance of 100 feet from the shaft. At a distance of 50 feet south of the main shaft the stope from the first level has been broken through to the surface, forming an air shaft.

Crosscuts : In the third level north, at a distance of 54 feet from the shaft, a crosscut has been driven east nine feet and discontinued, and at a further distance of 46 feet another has been driven west 5½ feet and discontinued also.

Stoping, first level, north : length of stope, 22 feet ; height above roof of drift 15 feet ; width, three feet. South : length of stope, 65 feet, leaving shaft pillar, 6 to 30 feet long ; height, raised to within several feet of surface ; width, 3 to 7 feet.

Second level, north : length of stope 40 feet, leaving shaft pillar four feet long ; height, raised to within about 5 feet of first level ; at height of 52 feet above level the stope is broken through to shaft, with opening three feet square ; width of stope, 3 to 9 feet. South : length of stope, 55 feet ; shaft pillar 4 feet long ; height, raised to first level ; width, 3½ to 6½ feet. Third level, north : length of stope, 100 feet ; shaft pillar 4 to 30 feet long ; height, raised to second level ; width, 2 to 10 feet. South : no stoping. Fourth level, north : length of stope, 80 feet ; shaft pillar, 30 to 50 feet long ; height, raised to third level ; width, 2 to 4 feet. South : no stoping. Fifth level, north : stoping commenced in inclined raise. South : no stoping. At a distance of 300 feet south of the main shaft a test pit has been sunk 22 feet on a branch of the main vein. It was the intention of the manager to drift south from the second level to this pit, in the hope of striking a valuable chute of ore. The vein pinches at the bottom of the shaft, but widens again in the drifts at the sixth level. At the end of the south it is 2½ feet wide, with walls rather indefinite. At the end of the north it is 20 inches wide, with good walls. The drainage of the mine is effected by pumps at the fifth and third levels. There is a considerable quantity of water coming down the shaft, but most of it is caught at the third level. No change has been made in the drilling and air compressing plant. The skip road has been completed to the fifth level, where a suitable timber pentice is provided, and a small auxiliary hoist installed for sinking. The dip of the shaft is practically uniform from the first level down. A new ¾ inch crucible steel wire hoisting cable 650 feet long has been installed.

Fifty feet of tramway connects the shaft with a new ore chute, which has been constructed at the loading terminal for the purpose of keeping the various grades of ore separate. The tramway buckets are loaded from gates at the bottom of the chute. Ten buckets are in use. No change has been made in the mill. As stated in the preceding report, the mine had been left in poor condition by the old company, but under the new management it is being improved with reasonable expedition. The ventilation in the summer time was poor, but since the air shaft has been opened up and winze connection made between all the levels (except the sixth) there has been an improvement in this respect. In the second, third and fourth levels drifts under stopes have been roofed over with suitable stulls and lagging. Instructions were left to do likewise in other parts of the mine where work was in progress. Owing to irregularities in the shaft a straight skip road could not be constructed, and consequently the skip would sometimes leave the track ; so instructions were left to provide suitable back-timbers to prevent this. The ladderway is suitably constructed as far as the fifth level, with the exception that the portion between the fourth and fifth levels has not been cased off from the hoisting compartment. There was no ladderway below the fifth level. Instructions were left to

supply these deficiencies. The captain of the mine is E. J. O'Brien, and the mill superintendent is George Verry. At the time of my last visit there was a total force of 55, including 24 miners.

I received a letter from Mr. Flaherty under date of Jan. 4, from which I extract the following: "Regarding the measurements in the mine, I would state that the shaft is now 480 feet in depth, and we are about to open up the seventh level at the 500 foot mark. The sixth level is driven to the north a distance of 71 feet, and to the south a distance of 35 feet, making the opening, including the shaft, on the strike of the vein about 116 feet. The fifth level to the south has been driven 43 feet, and the fourth to the north has been driven 224 feet from the shaft. The shaft is completely equipped with ladderway, division, etc., and we are now running the skip to the sixth level. I would state that all headings and the bottom of the shaft, so far as new development work shows, are in ore. I am handicapped for want of skilled miners, and cannot push the drifting on the different levels as fast as I would wish. The sinking is going on fairly well."

RANDOLPH MINE.

The Randolph mine consists of location AL115, a 40 acre location adjoining the Golden Star on the west. It is owned by the Randolph Gold Mining Company of Ontario, Limited. The formation is an extension of the Golden Star and JO41, being composed chiefly of massive greenstones, felsite, etc., with conglomerate on the southern half of the location. The vein is traceable about 500 feet, and varies in width from a few inches to three or four feet. The main shaft is 6 by 8 feet in cross section, and was 95½ feet deep on Oct. 29, the date of my last inspection. At a depth of 85 feet a drift has been run east 21¾ feet and one west 34 feet. A No. 5 Cameron pump is stationed in the latter drift, in which a 5 foot cistern has been sunk. The shaft is timbered for a depth of 18 feet and a suitable ladderway constructed. A small duplex hoist has been installed, with suitable head frame and return tubular boiler. At a distance of 100 feet east of the shaft a test pit has been sunk 3 feet, and 300 feet west of the shaft another has been sunk 11 feet. The buildings consist of engine house and dry, blacksmith shop and boarding camps. Neil Berger is manager of the mine. The total force is 17; the number of miners 12.

ISABELLA MINE.

Operations have been in progress since early in the summer on AL113, a 40 acre location adjoining the Golden Star on the east, and known as the "Randolph Farm," as there is an area of several acres on the location which is soil, covered and under cultivation. The property has been bought by a company from Messrs. Berger and Randolph. The formation is similar to that of JO41. The vein is a well defined quartz body, from 2 to 10 feet wide, and traceable for five or six hundred feet, with a strike of north 15 or 20 degrees west. Over 200 feet of the vein has been stripped. The quartz is bluish white in color, and contains copper pyrites, galena and zinc blende. Values are said to be encouraging. At one point a test pit has been sunk to a depth of 10 feet, showing 3½ feet of vein with good walls quite free from the vein matter. At a distance of 300 feet northwest of this pit a 6 by 8 foot shaft has been sunk to a depth of 52 feet (and is being continued) on the junction between this vein and another. There is 6 by 8 feet of vein on surface, with well defined walls. The work is in charge of Neil Berger, who has a force of three miners and one surface man.

DECCA MINE.

The Decca mine has been in steady operation during the year. Daniel Morrison is now manager. The total force is 12, of whom six are miners. No. 2 shaft was full of water on each visit, and has not been in operation since early in the year. It is said to be 110 feet deep, with drifts started in both directions along the vein at a depth of 100 feet.

Work has been confined entirely to No. 1 shaft since the closing of No. 2. The vein here is much smaller, averaging probably a little over a foot, but quite rich. Much visible gold is found in it. The quartz is variable in color and is mostly dark, containing galena, zinc blende and copper and iron pyrites. The depth of shaft was 210 feet on Oct

menced along the vein. The first half of an Ingersoll duplex compression has been installed, with a 4 by 10 foot receiver and three No. 3 drills. Hoisting is done by a Lidgerwood duplex hoist, $\frac{3}{4}$ inch steel wire rope and bucket, sliding on pole skidway, and dumping by mechanism similar to that of the Manhattan, described farther on. The boiler is a 65 h.p., return tubular. The ladderway is suitably constructed as far as the first level. Below this suspended ladders are employed. Several broken rungs were found. Instructions were left to construct the ladderway according to the Mines Act and replace broken rungs. A suitable guard rail has been provided at the shaft mouth. The brake on the hoist was found to be improperly adjusted, so that a bucket of rock could not be held by it. Instructions were left to remedy this defect. The buildings on the property consist of two shaft houses, boiler and hoist house, 32 by 40 feet, two blacksmith shops, office and boarding camp.

LUCKY COON MINE.

The Lucky Coon is one of the oldest properties in the Lower Seine country. Some years had elapsed since it had been in operation some time previous to the present resumption of activities. It was originally owned by A. M. Robertson, the present manager, and others. At the time of its former operation it was under option by a company. A five stamp mill was erected and several shafts sunk on the different veins, the ore from which was being treated. But a disagreement arose between the owners and the operators, and as a result work was suspended and remained so until early in the summer of 1899, when the present company, the Lucky Coon Gold Mining Company, bought the property, and have been operating it since. The head office of the company is Keystone Block, West Superior, Wis; capital, \$1,000,000 in one dollar shares. President, J. S. Hillyer; first vice-president, Geo. H. Hillyer; second vice-president, W. J. Keating, Fort Francis, Ont.; secretary-treasurer, Carroll Corson, Duluth. The property consists of location 655 P, containing 147 acres, and situated about $2\frac{1}{2}$ miles north of Mine Centre, on the Government road.

The formation consists of protogine, and contains a number of well defined quartz fissure veins. Four shafts and several test pits have been sunk on the different veins. No. 1 shaft is said to be 50 feet, but has not been in operation since the re-opening of the mine. No 3 shaft is said to be 24 feet deep, but has not been in operation since the re-opening. No. 5 shaft is said to be 78 feet deep, but on the occasions of my visits of inspection it was temporarily closed down, and contained water to within 35 or 40 feet of the surface. The dip is nearly vertical, and the cross section 5 by 7 feet. A ladderway has been properly constructed and cased off from the hoisting compartment as far as the water level. Timbering extends for a depth of 21 feet. A suitable guard railing has been provided at the shaft mouth.

No. 2 shaft is 4 by 6 feet in cross section, and 108 feet deep. It is sunk on the vein, which has a nearly vertical dip. Drifting has been commenced at a depth of 100 feet. The shaft is timbered for a depth of 5 feet, and lagged for a depth of about 22 feet below this. A suitable guard railing is provided at the mouth, and a proper ladderway has been constructed. The hoisting plant consists of a small Ingersoll duplex hoist, $\frac{5}{8}$ inch steel wire cable, steel bucket, pole skidway and 30 h.p. locomotive boiler. An iron self-dumping car and short tramway are provided on the surface.

The vein on which No. 2 shaft is sunk is of considerable width and well defined. There are parallel veins on both sides; one about 100 feet northwest, and one about 200 feet southeast, both of which can be economically reached by crosscutting from No. 2 shaft.

The buildings on the property consist of two hoist houses, two blacksmith shops, boarding and sleeping camps, old mill building and several other old log structures.

There was only a small force of seven altogether, of whom three were miners, working all summer. At the time of my last visit, Oct. 28, work was suspended altogether, and had been so since August.

MANHATTAN MINE.

The Manhattan mine consists of location K231, adjoining the Decca, and is distant about $1\frac{3}{4}$ miles north of Mine Centre on the Government road. It is owned by the Man-

hattan Gold Mining Company of Canada, Limited, with head office at Montreal. Frank Peterson of New York bought the property for the above company from Bush Wining, and Mr. Peterson is now manager. Operations were commenced in the latter part of 1898, and, with one or two intermissions, have been going on steadily since. A total force of seven is employed, not including the manager. There are four miners, working day and night shifts. The formation is protogine, and the vein is a quartz body of considerable width at the point where the shaft is sunk. The shaft had reached a depth of 170 feet on Oct. 28, the date of my last visit, and has a dip of 82° northwest. At a depth of 100 feet a crosscut has been driven northwest 40 feet, crossing the vein and passing through about 16 feet of quartz altogether. The shaft was supposed to have been sunk on the foot wall of the vein, but was in reality sunk in the wall, which consists of country rock mixed with quartz. A considerable quantity of the quartz is white and glassy in appearance, but some very nice looking ore containing galena, zinc blende and other minerals is encountered in the shaft. Visible gold is found also. It is the intention of the company to sink to a depth of 200 feet, and then drift and crosscut. Probably another shaft will be sunk farther up the hill, at a more convenient location for regular mining operations, when the vein has been shown up well by the present workings. Machine drills operated by steam are employed, the exhaust steam being conducted by a 12 by 12 inch wooden pipe to the surface. The hoisting plant consists of a small duplex hoist, horizontal boiler, steel wire cable, steel bucket and pole skidway. The head frame is neat and secure. The dumping mechanism is economical and convenient. The bucket is provided with two horns six inches in length, one on each side near the bottom. Next to the chute the skids are spread, allowing the bucket to fall between so that the horns slide on the skids. When the required height is reached the engineer at the hoist by pulling a lever throws out a couple of pins, which catch the horns of the bucket as the latter is lowered, and the bucket thus turns over and dumps into the chute, underneath which is the tram car.

The ladderway at the time of my last visit consisted of ladders suspended for a distance of 50 or 60 feet, with no means of reaching a greater depth other than by the bucket. Ladders were, however, being constructed at the time for the completion of the ladderway. Instructions were left to construct the ladderway according to the Mines Act before Nov. 10, 1899. The mouth of the shaft, both hoisting compartment and ladderway, were neatly fenced, and the mine in other respects was in a suitable condition. Buildings consist of a shaft house, hoist house, blacksmith shop, office, manager's dwelling and boarding camps.

GOLDEN CRESCENT MINE.

Work has been resumed on the AD2 property, now called the Golden Crescent mine, since the spring of 1899, after having been suspended for more than a year. The property consists of locations AD2, 3 and 4, and is owned by the Golden Crescent Mining and Exploration Company of Ontario, Limited, with head quarters at Duluth, Minn.; capital \$1,000,000 in one dollar shares. President, H. M. Bradely, Duluth; vice-president, J. B. Kelil; secretary, Geo. H. Claypool; treasurer, Chas. F. Leland. The manager of the mine is W. G. La Rue; foreman, Thos. Peller. Total force, 10; number of miners 6, working three eight-hour shifts.

Work has been principally confined to the shaft in the Gem tunnel, but a little has been done at a couple of other places since the new company has taken hold. The test pit on the Contact vein on AD4 has been sunk to a depth of $34\frac{2}{3}$ feet. The Moose tunnel has been driven a few feet more, making its present length $153\frac{1}{2}$ feet, but it has been discontinued again.

The main shaft, or the shaft in the Gem tunnel mentioned above, is 112 feet deep and is being continued. The cross section is $4\frac{1}{2}$ by 9 feet wide, inside the timber. The tunnel is passed through at a depth of 28 feet. At a depth of 78 feet a pump chamber has been provided, with a No. 5 Cameron vertical pump. At a depth of 88 feet a drift has been run east along the vein 24 feet and one west 10 feet. The shaft is timbered from the surface to the roof of the tunnel, and cased in where it passes through the latter, leaving openings for passage from shaft to tunnel and guard rails across. A suitable ladderway has been constructed, but is not cased off below the tunnel. Instructions were left to have this done. The shaft mouth has been provided with a suitable guard railing.

Some large insecure masses of rock at the mouth of the tunnel had been propped up with light timbers ; these were blasted down. The hoisting machinery consists of a small duplex hoist 400 feet of $\frac{1}{2}$ inch steel wire cable, 800 pound steel bucket, locomotive boiler 16 $\frac{1}{2}$ feet long by 42 inches diameter, pole skidway and head frame 16 feet high. The buildings on the property consist of engine and boiler house, blacksmith shop, office, boarding camps, etc.

FERGUSON MINE.

Mr. John Angove, a Cornish mining engineer, made an examination of the Ferguson mine for the present owners, viz, the Seine River (Ont.) Gold Mining Company, Limited, with head office, 1 Castle Court, London, E. C, England. Several weeks were spent by the engineer on the property, and all the shafts, five in number, were pumped out and sampled. The testing of the samples was all done by panning. If the report is satisfactory it is expected that the mine will be re-opened. All shafts and test pits have been fenced according to instructions.

OLIVE MINE.

A change has been made in the management of the Olive mine since last report. N. B. Hall, an energetic and capable mining engineer, has succeeded W. A. Preston, who held this position since the commencement of operations. Mr. Preston is still managing director of the company, but his duties in connection with the prospecting and developing of other properties owned by the Preston Gold Mining Company, the parent of the Olive Gold Company which owns this mine, preclude his holding a position which should occupy a man's time completely. The installation of additional milling machinery has led to variations in the number of men employed. There has been an average of about 50 throughout the year, including from 12 to 22 miners.

The main shaft is 251 feet deep. First level: West drift, 181 feet 10 inches ; east drift, driven to connect with drift from B shaft, a total distance of 329 feet ; drift east of B shaft, 199 feet, making a total length of drifting at the first level of 705 feet, including length of shafts ; cross section of drifts from B shaft, 6 by 7 feet, other drifts, 4 by 6 feet, and 5 by 7 feet.

Second level: East drift, 186 feet ; west drift, 88 feet.

Third level: Depth, 245 feet ; east drift, 31 feet ; west drift, 147 feet 4 inches ; crosscut south from shaft, 76 $\frac{1}{2}$ feet with cross section 4 $\frac{1}{2}$ by 6 $\frac{1}{2}$ feet ; crosscut, or chamber, north of shaft ; length, 14 feet ; width, 10 feet ; height, 7 feet.

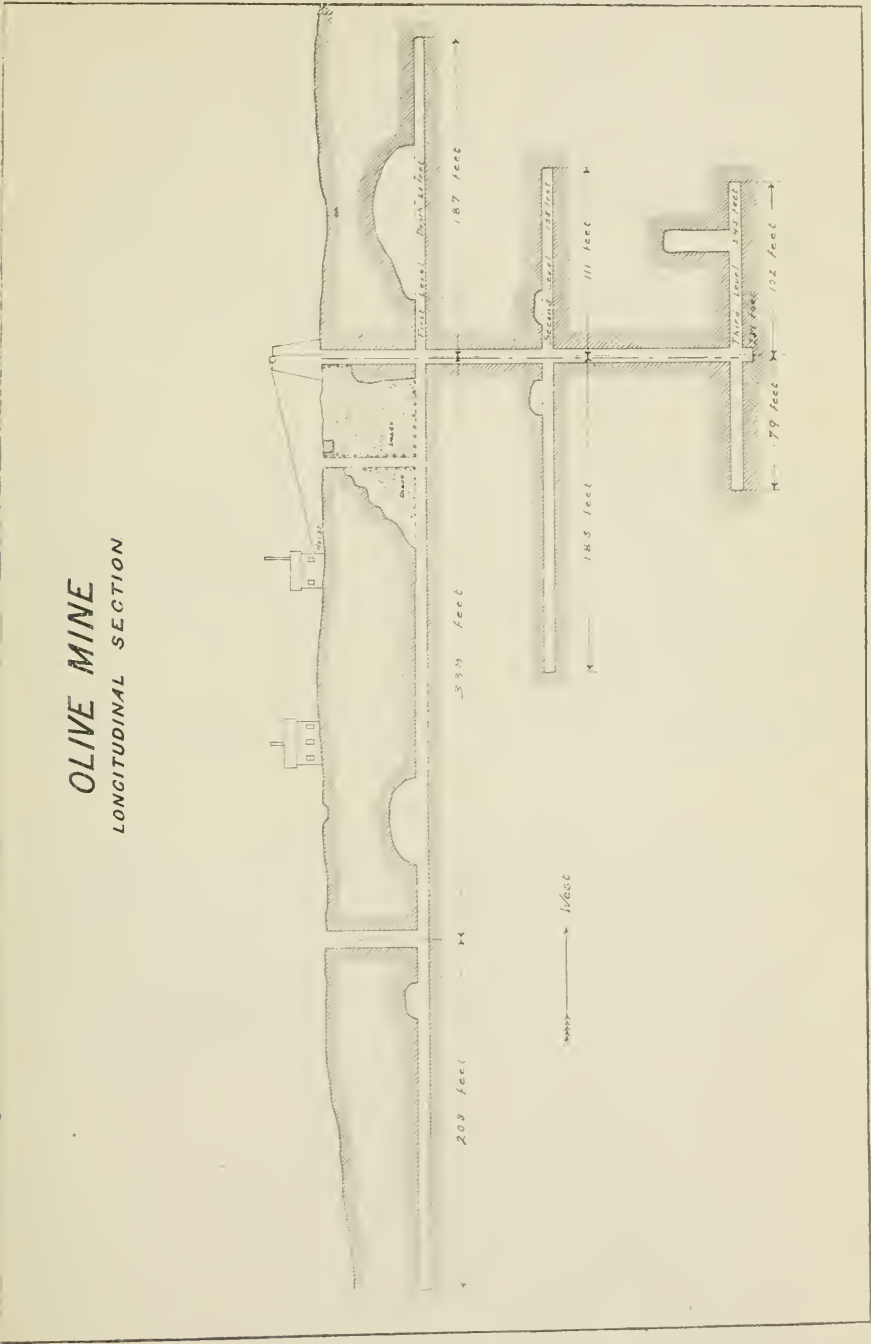
The following stoping has been done: First level, east of main shaft: All ore has been stoped out between the main and air shaft, a distance of 60 feet, leaving a small pillar at each, and the stoped out space has been filled to the surface with broken rock, supported on stulls along the roof of the drift. The stope has been carried east of the air shaft, but this work has been mentioned in last year's report. West of main shaft: Length of stope, 89 feet ; height above drift, 18 feet ; width, 3 to 4 feet. Third level, west of shaft: Length of stope, 13 feet ; height above drift, 21 feet ; width, 3 $\frac{1}{2}$ feet. No change has been made in the hoisting plant of the main shaft. B shaft has been provided with a steam hoisting plant, consisting of a small duplex hoist, $\frac{5}{8}$ inch steel wire cable, bucket, pole skidway and head frame 22 feet high. One of the old mill boilers has been placed alongside of the original hoist boiler to supply the additional power required. Two hundred feet of tramway have been constructed from B shaft to the main tramway, extending from the main shaft to the mill.

The main shaft is in a satisfactory condition. The ladderway has been suitably constructed to the third level. Instructions were left to provide a ladderway in B shaft according to the requirements of the Mines Act, and also a guard rail at the shaft mouth.

An addition of three batteries of five stamps each is being made to the present mill, giving a total of 25 stamps. At the time of my last inspection, Oct. 28, the building addition was completed, the ore bins constructed and the mortars set in place. All the machinery was on the premises. A new 50 h p. boiler has been installed and connected with two others.

The increase in the milling capacity is not necessarily being made in accordance with the amount of developement work in the mine, but more as a result of a further know-

ledge of the ore body. The Olive ore body has been sufficiently described in former reports without going into detail here. It is well known as a small but persistent and rich



Scale : 110 feet = 1 inch.

quartz vein in a belt of schist several hundred feet in width. The schist varies in richness in different places; the best values are obtained next to the vein and where the schist contains small quartz stringers, which occur more or less reticulated. A certain

amount of the schist has always been milled along with the vein matter. The company intend with the increased milling capacity to mine and mill from 5 to 7 feet of the schist along with the vein matter. Owing to the great expense of getting in machinery further additions to the mill will not be made until the new railway, which will run within a few hundred yards of the mine, is constructed. The mill may then be increased to any extent from 100 stamps upwards, and the greater part if not all of the body of schist treated. The Preston company bought two diamond drills early in the season for exploratory work on their properties. One of these was employed at the bottom of the main shaft of the Olive mine, testing the body of schist. Bore holes made north and south showed a width of 430 feet of schist, or ore, which is of course low grade; but from what I could learn it can be profitably treated by a large mill. A new two-storey office, 24 by 30 feet in size, has been built, besides a private dwelling for the engineer, and one for the manager is to be built soon.

I received a letter from Mr. Hall under date of Jan. 19, 1900, as follows: "I beg to submit the following information relative to the Olive mine: Depth of A shaft, 245 feet; B shaft, 65 feet. Drifting done in A shaft: First level, west, 181 feet 10 inches; east, 127 feet. Second level: west, 106 feet; east, 178 feet 2 inches. Third level: west, 96 feet 11 inches; east, 74 feet. Drifting in B shaft: west, 202 feet; east, 199 feet. Length of drift connecting A and B shafts, 329 feet. Stopping: East drift, B shaft, 50 by 25 feet; west drift, 20 by 12 feet. In A shaft: First level, west drift, 35 by 36 feet: Second level, west drift, 4 by 20 feet; east drift, 20 by 6 feet: Third level, west, raise 45 feet. These measurements are up to Dec. 31.

"We started the 25 stamps on the 22nd of November, and have been running steadily since, with the exception of a few days when we were changing the crusher from the mill to the shaft, where we have an ore bin of 500 tons capacity, crusher and elevator, which works very nicely. Our new tram, 900 feet long, works like a charm. We have no trouble in hoisting, crushing and tramping 60 to 75 tons per day. We also have the new office, sleeping camp, assayer's house and shaft house completed, and considerable repairing done."

On G69, one of the Olive mine locations on the south, a 6 by 7 foot shaft has been sunk to a depth of 65 feet, with 27 feet of cross-cutting. The ore body consists of altered green schist, heavily charged with pyrites, and impregnated more or less with quartz.

SWEDE BOY MINE.

The Swede Boy mine consists of location E237, with an area of 43 acres, situated about four miles east of the Olive, or eight miles north of Mine Centre, on the south shore of Little Turtle lake. It can be reached from Mine Centre by land, but the easiest method is to take the road to the Golden Star, or the Olive landing on the south side of Bad Vermilion, cross Bad Vermilion to the Swede Boy landing on the north side of the lake, and walk a portage of a mile in length, which leads to the mine. The property is owned by the Headlight Gold Mining Company of Ontario, Limited; head office, Duluth, Minn., capital of company, \$1000,000 in one dollar shares. President, J. P. Rossman, Duluth; vice-president, Geo. V. Burgess, Duluth; secretary-treasurer, A. E. McManus, Duluth. The manager of the mine is John McLeod. A force of 10 or 12, including from 4 to 8 miners, has been employed all summer. I visited the property on Aug. 11, and on Oct. 28.

The formation is a dark green schist with a strike of about east and west. There are two veins about 100 feet apart, and running parallel with the strike of the schists. The south vein is exposed in a test pit several hundred feet southeast of the main shaft. There is 8 or 10 feet of almost pure quartz, which possesses a schistose structure. This is the best showing of the vein, which is exposed very little. The north vein, on which the shaft is sunk, is exposed in several places by blasting and stripping. It reveals a width of 4 or 5 feet, and consists of quartz and schist mixed, and well mineralized. The schist between the veins, and probably even beyond them, contains mineralized and quartz impregnated zones, and possibly a considerable quantity of the rock will prove pay ore. Close to the shore of the lake, and at a convenient elevation for dumping, a shaft 6 by 7 feet in cross section has been sunk to a depth of 105 feet, and is being continued. It is vertical to the first level, a depth of 75 feet, and has a dip of 70° north below this. Another vein has been struck at the level, and is being followed. At the level a crosscut

has been driven south $75\frac{1}{2}$ feet, and is being continued to cut the other vein. A crosscut has also been driven north $16\frac{1}{2}$ feet and is discontinued. A drift has been driven east from the shaft $10\frac{1}{2}$ feet and one west 6 feet. For hoisting, a small duplex hoist, $\frac{5}{8}$ inch steel wire cable and 500 lb. steel bucket are employed. Steam is furnished by an 18 h.p. upright boiler. A pump is stationed above the level for drainage. A "Buffalo" blower, operated by belt from hoist, with six inch canvas tubing extending down shafts and into drifts, is employed for ventilation. It was observed to be the practice to have men lowered in the bucket to carry the end of the tubing into the crosscut to clear out the smoke and gases after blasting; and this being a dangerous practice it was recommended to employ iron piping instead of canvas, which could be extended permanently down the shaft and into drifts and crosscuts a sufficient distance to work effectually, without the necessity of men endangering themselves by going down in the smoke. A ladderway, provided with platforms at suitable intervals, has been constructed as far as the first level. Instructions were left to have it cased off from the hoisting compartment, and also to have the ladders extend from $3\frac{1}{2}$ to 4 feet above the man-holes in the platforms. Instructions were also left to place a guard rail all around the shaft mouth and one around the hoisting compartment at the first level. The buildings on the property consist of hoist-house, office, manager's dwelling and boarding camps.

ALICE A. MINE.

The Alice A. mine has been in operation for the greater part of the year. In the fall of 1898 a Tremaine mill was installed for test purposes; the machinery consisting of one two-stamp Tremaine mill, Gates feeder, No. 7, Gates crusher, Frue vanner, with six foot plain belt, two small upright engines for crusher and for vanner, and two upright boilers. From 150 to 200 tons of ore, taken partly from the main shaft and partly from test pits at various places on the property, were treated. The conclusion has been reached that a large percentage of the schist, which constitutes the principal portion of the formation on this property, can be profitably treated by a plant having a capacity of 200 or more tons per day. But by taking only the richest ore a much smaller plant would probably be profitable. Mr. Hillyer, the president of the company, has spent a considerable portion of his time in England endeavoring to arrange a sale of the property on such terms that a large mill will be erected and the present company retain an interest in the property. At the time of my last inspection, Aug. 9, the main shaft was 95 feet deep. At a depth of 60 feet a crosscut had been driven north 35 feet. This shaft is only for test purposes; sinking will be continued, with crosscutting in both directions across the ore body at certain intervals, until a satisfactory knowledge of the ore body has been obtained. The regular mining, when the large mill is installed, will be open work. A small duplex hoist has been installed, and also a four-drill Ingersoll straight line compressor, and machine drills. The boiler is locomotive style, and 35 h.p. The boiler and engine house is 26 by 30 feet in size, and neatly constructed. The company has put a saw mill with a capacity of 10,000 feet per day on the property. The manager of the mine is T. G. Prideaux. A total force of about 14 were employed. When visiting that section of the district in the latter part of October I learned from Mr. Prideaux that operations at the mine were suspended for a while.

GOLD BUG AND EMMA ABBOTT LOCATIONS.

An occasion was taken advantage of while at the Alice A. to walk over the Gold Bug and Emma Abbott locations, adjoining the Alice A. on the west and east respectively. The Gold Bug location is P660, containing 80 acres, and is owned by the Gold Bug Mining Company, Limited; capital, \$1,200,000. President, W. J. Keating, Fort Francis, Ont; vice-president, Hugh Steele; secretary and treasurer, Carroll Corson, Duluth. Offices, Mine Centre, Ont, and Keystone Block, West Superior, Wis. The Emma Abbott location is K215, consisting of 40 acres, and owned by the Emma Abbott Gold Mining Company with head office at West Superior, Wis.; capital, \$1,000,000. President, Henry Clay Clark, Chicago; vice-president, Hugh Steele, Duluth; secretary, John S. Dodge, Minneapolis; treasurer, Lee J. Moss, West Superior.

The formation in each case is felsite schist, cut by large greenstone dikes, similar to the Alice A. Parts of the locations are swamp and bush covered, but a considerable

area is on high ground, which is largely almost bare rock, with a little moss, etc., and a light growth of timber. The schist is filled with small stringers of quartz from a fraction of an inch upwards, and in some places quartz veins 2 feet or more in width are exposed. In two or three of these veins there were large quantities of galena, copper and iron pyrites, etc. Test pits have been sunk on the quartz exposures in several places. On the whole the properties are very promising looking as prospects.

OTHER PROPERTIES.

The Rice and Thorbus property above Sturgeon Falls has not been in operation during the year, although Mr. Rice informed me last summer that he expected to have work resumed in the fall. It was examined by T. R. Deacon of Rat Portage for the company. Several other properties in the Lower Seine locality have been in operation more or less during the summer, but were not visited by me. At Calm lake, above Sturgeon Falls, some properties have been worked, but I did not visit this locality either.

UPPER SEINE REGION.

The condition of the mining industry in the Sawbill and Island Falls country is about the same. A number of new properties have been opened up and on some of the old ones work has been suspended. The prospector has extended his field of operations both northward and southward, and has been followed by the miner. Considering the inaccessibility of most of the properties in this locality, it would hardly be expected that mining would be carried on to the extent to which it is. The new railway will, however, help matters in this respect to a considerable extent.

DULUTH MINING CO. OF ONTARIO, LIMITED.

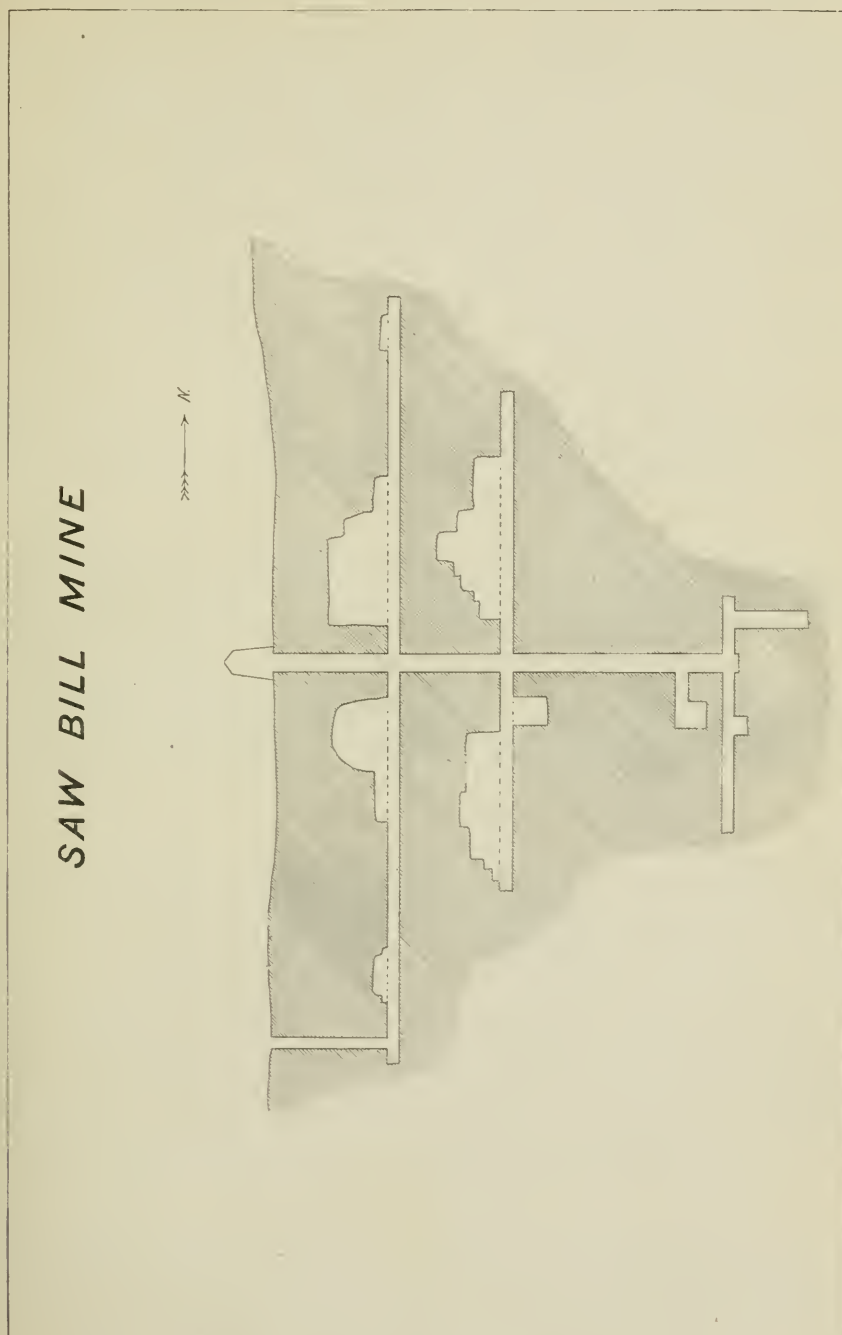
While on my way to the Sawbill I travelled on the stage with Messrs. Upham and Howenstein of the Duluth Mining Company of Ontario, Limited, who were operating on several locations a few miles north of Sawbill. I did not visit the properties, but got the following information from the above mentioned persons: On ES20 a shaft had been sunk 30 feet, and on AL303 a shaft had been sunk 46 feet on a large reef similar to the Hammond Reef. Ten men, including six miners, were employed all summer, and work will be continued all winter.

HAMMOND REEF MINE.

The property of the Hammond Reef consists of nine locations, and was originally divided between two companies, viz: the Hammond Gold Reef Mining Company, Limited, which owned two locations 337 and 338X, and the Folger-Hammond Gold Reef Mines Company, Limited, which owned the remaining seven locations, 316 to 322X. Both companies were composed largely of the same people. Developments showed that the installation of a large mill was necessary for the profitable treatment of the ore; and besides, there was a water power to be developed at considerable expense. Consequently, according to the dictates of mutual interest and advantage, the two companies amalgamated under the name of the Hammond Reef Consolidated Mining Company, Limited, with a capital of \$5,000,000 in one dollar shares. I visited the mine on May 30 and found the machinery for 30 additional stamps on the premises, the foundations of the mill being prepared, and work on the water power in progress. No mining work was being done. On Oct. 2 I made my second and last visit and noted the following state of affairs: New work on 316X; about a quarter of an acre of the reef had been stripped and about 800 tons of ore from the large pit piled up on the surface, awaiting treatment. Instructions were given to keep the walls of the pit carefully scaled.

All the machinery was on the premises for the mill, crusher, aerial tramway and the electric power plant. The mill building was completed all but the roof, which was being put on. The size of the building is 35 by 100 feet, and height 65 feet. The new mill is

an addition to the old 10 stamp mill ; so that the total number of stamps is now 40. The new stamps were in place, and the mill was within a month of completion at the



time of my last visit. The crusher house was under construction. It is situated close to the pit, about 800 feet from the mill. The crusher is a Blake, with a capacity of 200 tons per 24 hours. A Bleichert aerial tramway will convey the ore from the crusher to

the mill. The discharge terminal is 70 feet above the loading terminal. Six buckets with a capacity of 600 lb. each will be employed. The cable for loading buckets is one inch in diameter, and for empties $\frac{7}{8}$ inch. The traction cable is $\frac{1}{2}$ inch. Only one standard will be provided between the terminals. The ore will be raised from the pit to the crusher by a power cable derrick. The water power is on the creek which runs from Clearwater lake into Sawbill, and is about two miles from the mill. Three dams have been constructed, including a small dam at Clearwater lake, 90 feet long, 10 feet wide and about 10 feet high at the centre. It is built of cribwork with broken stone filling, provided with a broken stone retaining wall and planked and sealed with earth in front. A gate is provided in the centre. Further down the creek there is a large dam to provide the head. It is about 150 feet long, 14 feet wide and about 18 feet high. The construction is similar to the preceding. The flume dam alongside is 65 feet long and constructed of framed timber with broken stone filling and earth seal, and flume gate in the centre. The flume is a round wooden tube constructed of two inch planks with iron hoops six feet apart. It is 700 feet long and five feet in diameter. Owing to natural obstacles it has a bend of 90° close to the dam, and another bend of a more obtuse angle about 400 feet further down. The head is 50 feet. Two turbines aggregating 325 h.p. have been installed. The generator, which furnishes 225 h.p., is not yet in place. The generator base is a solid piece of metal and weighs five tons. Its transportation from Bonheur to the head of Sawbill lake, a distance of 30 miles, was a serious problem owing to the very bad condition of the roads. A special waggon built to order with six inch tires was employed. The length of the transmission wire from the dam to the mill is 11,659 feet. Where it passes overland a clearing 40 feet wide is made along the route. The lake is crossed at the narrowest point, where there are several islands that are utilized. About 800 feet of water altogether is crossed. The wire is supported on poles for the entire distance. Three stone-filled cribs have been constructed to support the poles where the lake is crossed. There are two motors, one of 100 h.p. for the mill and one of 25 h.p. for the crusher. Neither were installed. About 200 yards of new road has been constructed in the vicinity of the mill, and about a mile of road connecting Sawbill and Clearwater lakes. A new pumping station has been provided at the lake. The pump is a Snow duplex. A conduit extends 275 feet out into the lake, owing to shallow water near the shore. Two lines of piping 2 and $2\frac{1}{2}$ inches in diameter extend to the mill. Wm. Tedford is manager of the mine. The total force is 40, of whom 8 are miners.

SAWBILL MINE.

I visited the Sawbill mine on two occasions during the year; the first time on May 30, when I inspected the main shaft workings, and the second occasion on Oct. 2, when the shaft was full of water. The option under which the mine was being worked by a syndicate had expired just previous to the time of my second visit, and all the men were discharged. Captain J. P. Williams, the manager, the engineer and one or two others were still there. The mine will probably be closed down until the company is reorganized. Sinking, drifting and stoping had been carried on in the main shaft, and test-pitting on the surface; and the mill was in operation intermittently making mill tests from various parts of the mine, underground and on the surface. On Sept. 20, 1898, while drilling at the bottom of the shaft, then 230 feet deep, water was struck which flowed out of the drill hole with great force, and continued so for months, flooding the lower part of the shaft and preventing sinking. Additional pumps were installed to keep the water down as much as possible. A drift was then driven along the vein at a depth of 220 feet, and a winze sunk at the end so that the water could be tapped and the pumps installed there so as to enable sinking to be continued in the shaft. The difficulty was finally overcome, and when the next or third level was established, at a depth of 243 feet, the ground was found to be quite loose and fissured. The captain informed me of the remarkable fact that a large fissure 6 or 8 inches in width extended horizontally along the level with a dip to the west when the level was first opened, but this fissure gradually closed as a result of the movement or settling of the country rock. When I examined it in May the seam corresponding to the closed fissure was plainly evident, and the ground was quite loose and broken up. I made a tracing of the longitudinal section of the underground workings at the time of my last visit, and got the following measurements from it:

Depth of shaft, 245 feet. First level, north drift, 190 feet; south drift 208 feet. Second level, north drift, 138 feet; south drift, 132 feet. Sub-level, depth, 220 feet; south drift, 30 feet; winze or cistern at end, depth, 9 feet. Third level, depth, 243 feet; north drift, 30 feet; south drift, 85 feet; cistern in south drift, 8 feet deep; winze in north drift, 14 feet from shaft, 50 feet deep; making total depth of lowest workings 293 feet.

Stoping: First level, north drift, first stope, length, 80 feet; average height above drift, 23 feet. Second stope, length, 20 feet; average height, 3 feet. South drift, first stope, length, 65 feet; average height, 20 feet. Second stope, length, 28 feet; height, 7 feet. Second level, north drift, length of stope, 87 feet; average height, 20 feet. South drift, length of stope, 80 feet; average height, 17 feet. The following test-pitting has been done on the vein, north and south of the shaft. At a distance of 800 feet north of the shaft an open crosscut has been made about 80 feet in length, from which 1000 tons has been blasted out. At one end of the open cut a pit has been sunk 20 feet, and at the other end a pit 14 feet. A sheared zone with a line of faulting extends along the open cut and through both pits. Stringers of quartz occur in the sheared zone. A mill run of 40 or 50 tons was made from this opening. At a distance of several hundred feet south of the main shaft the vein has been stripped for 70 or 80 feet. Several test-pits have been sunk on outcroppings of what appears to be an extension of the Hammond Reef, directly east of the southern limit of the Sawbill vein. One pit is 20 feet deep, another 8 feet and another 4 feet. No change has been made in the machinery about the mine or mill. Instructions were left in the Inspector's Book to fence all test-pits, and also to examine and scale certain specified places in the main shaft.

ROY MINE.

Work has been going on intermittently at the Roy mine during the year. On the occasion of my visit, Oct. 1, the total force was 12, of whom 4 were miners; but 8 miners had been employed all summer. The manager is Roy Sweeney, and the mine captain John Chapman.

The shaft is 105 feet deep, with a dip of 50° to 60° north. At a depth of 50 feet a drift has been driven west 10 feet. At a depth of 100 feet a drift has been driven west 71 feet. At the end a crosscut has been driven north $17\frac{1}{2}$ feet, and one south 9 feet. At the same level a drift has been driven east from the shaft $55\frac{1}{2}$ feet, and at the end a crosscut north 7 feet and south 21 feet. The size of all drifts and crosscuts is 4 by $6\frac{1}{2}$ feet. The vein is quite strong in the shaft and drifts; at the end of the east drift there is 14 feet of quartz. The shaft is timbered for a depth of 13 feet and provided with suitable platforms at the levels. A ladderway extends to the bottom of the shaft, but is not divided off from the skipway and is in poor condition. A Northey pump is stationed at a depth of 90 feet. Ventilation is secured by live steam, which is conducted into the workings by an iron pipe. The hoisting plant consists of a small single cylinder hoist with 12 inch drum, $\frac{5}{8}$ inch steel wire cable, wooden bucket, four pole skidway and head frame 18 feet high, constructed of 6 by 6 inch timbers. A new 50 h.p. return tubular boiler has arrived and will be placed alongside the present one, which is of 10 h.p. A saw mill with a capacity of 12,000 feet per day has been put upon the property by the owners of the mine. The following instructions were left in the Inspector's Book: 1, Replace ladders above first level by others with more securely fastened rungs. 2, Close off ladderway from hoisting compartment, and provide landings at suitable distances apart. 3, Provide a suitable guard rail at shaft mouth and at man-hole on surface. 4, Keep walls of shaft carefully scaled. 5, Provide boiler with water tube.

PETTIGREW'S MINE.

W. D. Pettigrew of Winnipeg has been operating for the past two years in the Island Falls region. One of his properties consists of four 40 acre locations, viz., BG24, 25, 36 and 37, situated on King's lake about 14 miles up the Seine river measured along the winter road. The place can be reached by a slightly longer route by canoe, the last two miles being a foot trail. At the time of my visit, Sept. 30, the property was being worked under option by the Seine River Syndicate Mining Company, consisting of Scotch capitalists. The formation is altered granite. A ridge of the granite more altered than the formation in general, due doubtless to the fact of its having been a zone of

disturbance, extends through the property with a strike of northeast. The ridge zone or reef is about 100 feet in width, and has more or less well defined boundaries. A quartz vein several feet in width on surface but much larger underground occurs on the foot wall, and the hanging wall is marked by loose, faulted ground and stringers of quartz. The dip is about 45° northwest. The whole reef contains stringers of quartz to a greater or less degree in different parts. In general nature it is somewhat similar to the Hammond Reef. The quartz, where it occurs, is white, similar to that of the Sawbill, and contains coarse pyrite, copper sulphide and galena; native copper is also found in it. On BG24 a shaft 5 by 10 feet in size has been sunk vertically to a depth of 108 feet. It was commenced in the hanging wall and the reef was struck at a depth of about 50 feet. At a depth of 100 feet a crosscut 5 by 7 feet in cross section has been driven southeast through the reef to the foot wall, a distance of 64 feet. On the foot wall side 25 feet of quartz is passed through. At the end of the crosscut 14 feet of drifting has been done in the quartz. The hoisting plant consists of a 16 h. p. duplex hoist, $\frac{5}{8}$ inch steel wire cable, 36 inch sheave, steel bucket and head frame 16 feet high, neatly framed of 8 by 8 inch square timbers. A tramway and car is provided down below, and the same on surface. Drainage is secured by a Worthington pump of 40 gallons per minute capacity. A No. 5 Cameron sinking pump is also on the property, but has not yet been installed and is used for pumping water from a well to the tank for the boiler. Ventilation is secured by a blower on surface operated by the crusher engine. Six inch canvas tubing extends down the shaft and into the workings. Suitable timbering has been provided for a depth of 15 feet from the surface; and at a depth of 48 feet, where the shaft passes through the hanging wall of the reef, there is another 15 feet of timbering. A ladderway has been constructed with suitable platforms; but is only divided off from the hoisting compartment for a portion of the distance, a guard rail having been provided at each platform instead. There is a trap door at the shaft mouth, but no guard railing. On the southeast side of the reef there is a test shaft which is said to be 26 feet deep, but is partially filled with water and not fenced. Blasting and test pitting have been done at other places also along the strike of the foot wall. A mill has been installed for test purposes, but so far has only been operated for a short time during the winter previous to my visit. The machinery consists of a Tremaine steam two-stamp mill, Gates feeder, Blake crusher, 25 h. p. crusher engine and 40 h. p. locomotive boiler.

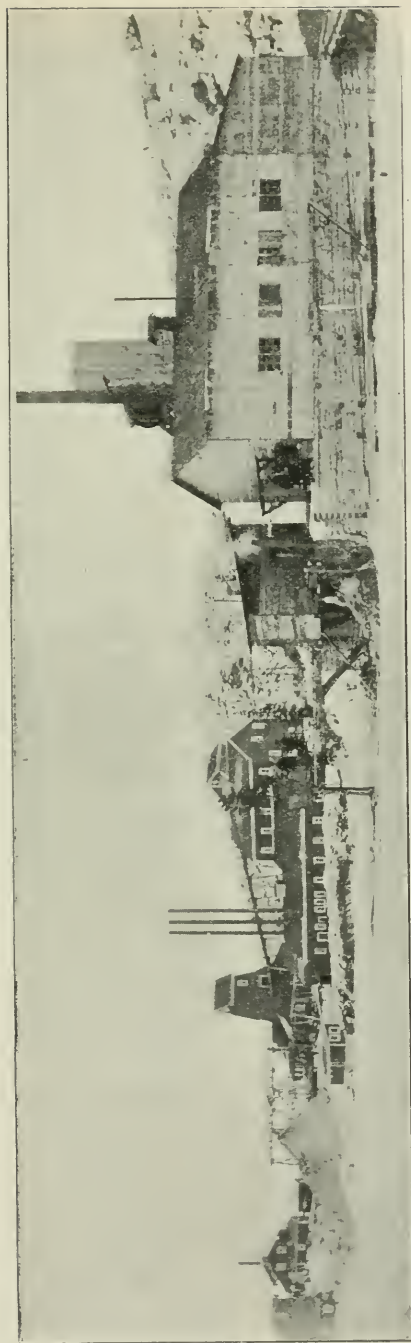
The following buildings are on the property: Dining and sleeping camps, office, store house, stables, powder house, blacksmith shop, hoist and boiler house 18 by 20 feet, and mill building same size. The manager of the mine is W. D. Pettigrew; superintendent, Jas. Huston; total force, 16; number of miners, six. The following instructions were left in the Inspector's Book: 1, Case off manway from hoisting compartment. 2, Provide suitable guard rail at shaft mouth. 3, Fence 26 foot test pit south of shaft.

LOCATION AL282.

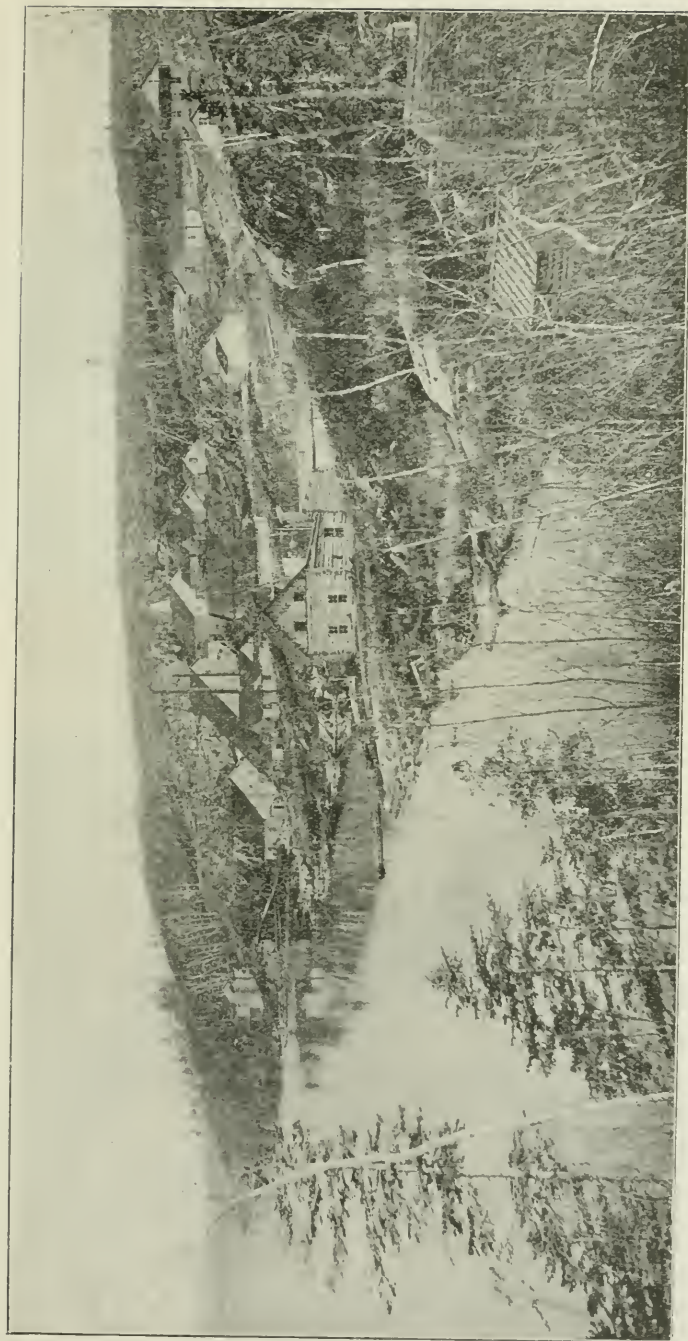
Operations had been resumed on AL282 a short time previous to my visit, Oct. 1, after having been suspended for the greater part of the year. The manager is James Hammond; superintendent, Adolph Lequyer; total force, 31; number of miners, 10. No sinking has been done since last report, but is just commenced. The shaft is 141 feet deep. At the first level, which is 96 feet from the surface, the northeast drift is 70 feet long, and the southwest drift 78 feet. The vein is a well defined quartz body in a band or dike of altered schistose greenstone about 6 feet in width. The country of this property, and in fact of all the Island Falls region, is altered granite. The greenstone dike material is quite soft, and well defined walls exist between it and the granite. The vein has also well defined walls, and ranges in width from 1 to 3 or 4 feet. A ladderway has been constructed to the bottom of the shaft, but is not cased off from the hoisting compartment; nor is it provided in the vertical part of the shaft with suitable platforms. Instructions were given to remedy these defects, and also to construct a platform at the first level and to provide a guard rail at the shaft mouth. A new 50 h. p. return tubular boiler has been installed, and also a new Williams mine pump.

OTHER PROPERTIES IN THE ISLAND FALLS REGION.

Two or three other properties were being worked in the Island Falls vicinity, but not to any great extent; and as they were out of the way, and it was getting late in the



22. Sultana and Burley Gold Mines, pp. 38, 42.



23. General View of Regina Gold Mine, p. 44.



24. Keeewatin Reduction Works, p. 88.



25. Mill and Shaft House of Regina Gold Mine, p. 44.



26. Mill of Combined Gold Mine, Camp Bay, p. 50.



27. View of portion of Railroad from Mine to Mill at Camp Bay (Combined Gold Mining Co.), p. 50.

season, I did not visit them. However I got some notes from J. S. Steele on work done on properties up there which he was interested in and of which he was manager. The Clearwater Gold Mining Company, which owns the Big Six mine mentioned in last year's report, owns several locations in this region. Mr. Steele is manager of the company's properties and gave me the following information: On BG43 a shaft had been sunk 113 feet and discontinued. On BG45 a shaft had been sunk 55 feet and is being continued. A steam hoist has been installed. A number of test-pits have been sunk on the same property from 3 to 15 feet in depth. The ore body is a large quartz vein associated with a band or dike of green schist, and the formation is altered granite. With regard to the Big Six mine on Eye lake, south of Clearwater lake, I did not visit the place this year, as Mr. Steele, the manager, informed me that there was not sufficient going on to warrant the expenditure of time so late in the season. He gave me the following notes on recent progress on the property: Depth of main shaft, 100 feet; depth of first level, 80 feet; drifting north, 70 feet; south, 30 feet; crosscut, 10 feet south of shaft; direction, west; length, 18 feet. The steam hoist has been installed, and also a three drill air-compressor with three machine drills. Some test-pitting has also been done since last year's report. The saw mill is in operation and a planer installed. The Hammond Reef and other properties are supplied with lumber from this mill, as the company has a timber limit in connection with its mining property. New camps have been built on the property.

RUST AND WEADOCK PROPERTIES.

On Oct. 3 Mr. Steele took me down by canoe to location 325X, a 40-acre location owned by himself and two others, Mr. Ezra Rust and Geo. W. Weadock, both of Saginaw, Mich. The property is situated on Jack's lake, about 12 miles or three or four hours travelling by canoe south of Sawbill. The route is by way of Moose lake and two other small lakes between it and Jack's lake, with short portages between. The formation is altered granite. A band or dike of greenstone extends through the same with a strike of northeast. Other dikes of the same rocks, also containing veins, occur close to the main dike. It is a general rule, as far as I have been able to observe, that all quartz veins in this altered granite formation are in or are associated with these greenstone dikes. It is well known that in the greenstone formation in other parts of the district the quartz veins as a rule are associated with felsite—generally occurring in dikes of felsite. This is more particularly true in the case of massive greenstone. In green schist many bedded or lenticular veins occur without the felsite. In the case of the altered granite we have the antithesis. In one case we have the quartz vein associated with or in fine grained siliceous dikes in a formation of basic rock or greenstone; and in the other, or the present case, quartz veins in or associated with fine grained basic or greenstone dikes in siliceous or granitic formation. The greenstone is usually schistose, especially next to the vein. Sometimes the whole dike is schistose, but it is the schistosity due to shearing and pressure, for wherever this feature occurs there is always distinct evidence of faulting, and the granite next to the schistose portion of the greenstone is more or less schistose, sometimes very markedly so. So that there is no doubt but all the bands of greenstone in this formation were originally massive, and of course of eruptive origin, and formed lines of weakness for the faulting, etc., of the country. These movements would, by shearing, grinding, etc., open up and otherwise render the zone of rock adjacent to the plane of faulting, or the dike, susceptible to vein-forming agencies.

The ore body or reef, loosely called a "vein" on this property, is an interesting deposit. At the north end of the outcrop an open cut 28 feet long, 5 feet wide and 5 feet deep, has been made across same. The reef here is about 20 feet in width. On one side there is a quartz vein with definite walls, from 6 to 24 inches in width, carrying large quantities of galena, zinc blende, pyrite, copper pyrites, and also visible gold. On the other side there is about 3½ feet of a poorer grade of quartz with indefinite walls. The material between consists of siliceous schistose matter, filled with small interlaminated plates or lenses of quartz and is the metamorphosed greenstone. A short distance south of the open cut a shaft 6 by 8 feet in size has been sunk to a depth of 45 feet on what is believed to be the wall of the reef, but as the granite next the reef is schistose and both the schistose granite and the greenstone are altered and impregnated with quartz, the walls of the reef or dike are rendered indefinite. The reef matter as seen in the shaft is mostly quartz,

which has displaced what was originally the greenstone. The schistose structure is as pronounced as ever, but what is left of the greenstone exists as mere leaves or plates of chloritic matter between the lenses of quartz. Visible gold is found in the shaft. The reef is mostly on elevated ground and well exposed. A few hundred feet south of the shaft it is cut by a narrow ravine which evidently represents a line of faulting. Between the shaft and the ravine the sheared or schistose character of the reef and granite adjoining is more pronounced than north of the shaft. South of the ravine the reef can be traced for a considerable distance, it is said for miles; but here the characteristics of the original dike do not seem to have been so much eliminated by shearing and alteration. Test-pitting and stripping have been done along the reef at intervals.

Another greenstone dike appears to branch off from the main one, and contains a quartz vein several feet in width but not traceable very far, nor very promising looking. There is a total force of 9 on the property, including 7 miners. Mr. Steele is manager of the work. The only building is a boarding camp. A temporary blacksmith's shop and a powder house have been erected, but others will be built soon.

The same parties own locations 682, 683, 684 and 685X, above Island Falls. I did not visit these properties, but was informed by Mr. Steele that a shaft had been sunk 52 feet on the line between 682 and 683X, with 24 feet of crosscutting at the bottom showing 24 feet of quartz.

LAKE SUPERIOR REGION.

Some exploration work was carried on in the Lake Superior region last year, but mining operations were not active.

EMPRESS MINE.

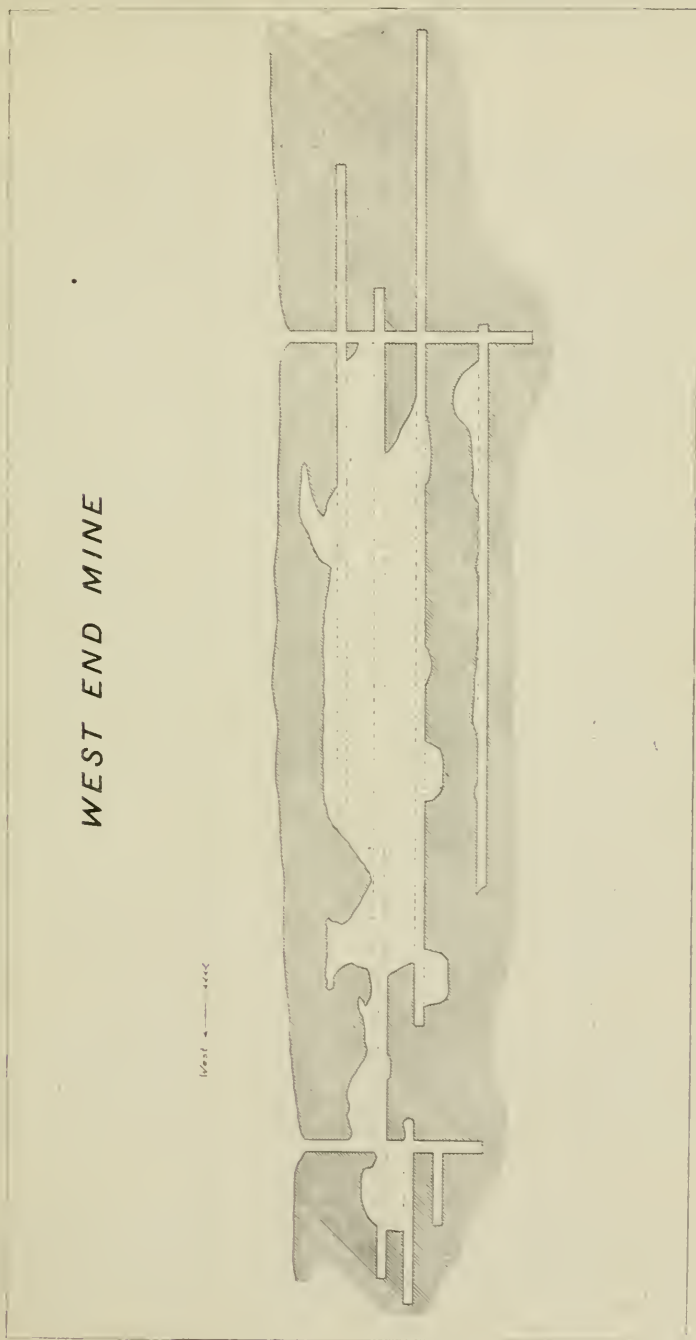
The Empress mine, which had been shut down for nearly two years, was re-opened in the spring of 1899 and work continued for the remainder of the year, when I was told it was again closed down. I visited the property on May 16 and Sept. 25. A report of the old workings is contained in the seventh report of the Bureau. Recent operations have been directed towards sinking a winze in No. 1 drift in the tunnel, and also doing a little further drifting and crosscutting in the tunnel level.

The winze is sunk from the end of No. 1 drift, which has been enlarged to provide a chamber for hoisting operations. The size of the winze is $5\frac{1}{2}$ by $7\frac{3}{4}$ feet, and the depth was 81 feet at the time of my last visit. It is sunk vertically into the ore body, which is over 100 feet wide. At a depth of 51 feet drifts 7 by 7 feet in cross section have been driven east and west 4 feet and $12\frac{1}{2}$ feet respectively. The ore body consists of pyritiferous hornblende schist containing stringers, bunches and veins of quartz. A vein of quartz 3 to $3\frac{1}{2}$ feet wide was passed through in the winze, where the drifting commenced. A considerable quantity of zinc blende was struck in the west drift; this is the first occurrence of this mineral so far known in the mine.

The second or No. 2 drift east in the tunnel has been driven to a total length of 103 feet, and a chamber at the end 8 feet high and 14 feet wide excavated for a diamond drill station. The third drift west has been driven a total distance of 108 feet. At a distance of 96 feet from the tunnel in this drift a crosscut has been driven north 22 feet and one south 42 feet. Machine drills operated by compressed air are employed. A small duplex hoist operated by compressed air is installed at the winze. Ventilation is secured by aspirator pipes, six inches in diameter, conducted from the workings to the mouth of the tunnel. Live steam is employed. No change has been made in the mill. It was being cleaned up for operation at the time of my last visit. A manager's dwelling and a new blacksmith shop have been built. The manager of the mine is Jas. O. Beebe; foreman, T. F. Waters; number of miners, four; total force, 14. The following instructions were left in the Inspector's Book: 1, Construct a ladderway in the winze according to the Mines Act, with division and platforms at suitable intervals. 2, Provide a trap door at least six inches thick at the level in the winze.

URSA MAJOR MINE.

I visited the Ursa Major mine on Sept. 25 and found that the shaft had been sunk to a depth of 117 feet, and neatly timbered for a depth of 80 feet. The hoisting plant



consists of a small duplex hoist, 32 h.p. locomotive boiler, wire cable and bucket. A pump station has been provided at a depth of 110 feet, but the pump was not instal-

led. An addition has been made to the shaft house for a hoist and boiler room. The superintendent of the mine was R. M. Chapman; total force, 14; number of miners, 7. Instructions were given to construct the ladderway according to the Mines Act, and also to provide a guard rail at the shaft mouth. On Dec. 1 received a letter from Captain J. P. Williams, late manager of the Sawbill, who had just been appointed manager in place of Mr. Chapman. He stated that the instructions regarding the ladderway etc., had been carried out.

WEST END SILVER MINE.

Some of the old silver mines in the Lake Superior region have been worked during the year, but the most successful work has been carried on in only one of them, which is known as the West End mine. This mine has been in continuous operation, mining, milling and shipping during the year. I visited the property on May 10 and on Feb. 20 of the year following. At the time of my second visit I found that the mill had been shut down since the beginning of the preceding month on account of the lack of water supply owing to the cold weather; but it will be started again when the thaw comes. The water is syphoned through a long pipe from a lake on the top of the mountain. At present only the rich ore is being shipped, while the mill rock is being piled in the stope underground until the mill is ready for operation again. The following are the underground measurements up to the date of my last visit: No. 1 shaft, depth, 150 feet, approximately (water in bottom). First level, depth, 53 feet; west drift, 84 feet; east drift, connected with No. 2 shaft. Second level, depth, 70 feet; west drift, 102 feet; east drift, 14 feet. Third level, depth, 88 feet; west drift, 50 feet. Stopping: West of shaft, above second level, length, 52 feet; height above floor of level, 35 feet. East of shaft, above first level, length, 90 feet; height above floor of level, 13 to 25 feet.

No. 2 shaft, depth, about 155 feet (about 35 feet of sinking done since last report). First level—see last report. Second level; west drift, connected with No. 1 shaft. Third level; west drift, 444 feet. Fourth level; depth, 132½ feet; west drift, 355 feet; east drift, 5 feet. Stopping: West of shaft, above third level, length, 410 feet; average height above floor of level, 53 feet. Below third level (underhand), No. 1 stope, length, 38 feet; depth, 35 feet. No. 2 stope, length, 40 feet; depth, 13 feet. No. 3 stope, length, 25 feet; depth, 5 feet. Above fourth level; length, 85 feet; height above floor, 11 to 23 feet. Stulls for supporting the broken ore, with chutes at intervals of 12 feet, are under all stopes. At present, and until the mill starts, the ore from the lower levels is hoisted to the second, where a chute has been provided in the shaft to load the cars in the level. The ore is dumped into the stope below the second level and will be removed from the chutes in the third. Drainage is secured by four pumps in the mine; a Cameron No. 7 and a Dean at the fourth level in No. 2 shaft; and a Northey and a Cameron, each No. 7, at the second level in No. 1 shaft. A Copeland and Bacon duplex hoist with 8 by 12 inch cylinders and 36 inch drum has been installed at No. 1 shaft. The cable is $\frac{3}{4}$ inch in diameter, steel wire, and 400 feet long. A bucket is employed and a pole skidway constructed. The boiler is 35 h. p. locomotive style. A new tramway on trestle work about 350 feet long has been laid from No. 1 shaft to the mill. A new wood chute about 250 feet in length has been constructed south of the mill from the top of the mountain, but is not used at present as the wood supply is pretty well exhausted from that source and is being obtained now between the mine and the railway track. The force at present is somewhat reduced owing to the mill not being in operation; the total is 30, of whom 16 are miners. No change has been made in the management.

PORCUPINE SILVER MINE.

The Porcupine mine is owned by the syndicate which is operating the West End mine. It consists of location 96T, containing 160 acres, and is situated 28 miles from Port Arthur on the colonization road, and two miles south of the P.A.D. and W. railway with which it is connected by a road. This is an old property which had been somewhat extensively worked, but had been idle for several years previous to the recent reopening. Accounts of it will be found in the early reports of the Bureau. There are several old tunnels and shafts on the property. Recent operations, which have extended over a period of about a year, have been confined to driving a prospecting tunnel into the

foot of the mountain to reach the junction of two veins. I visited the property on May 11, when the tunnel was in 96 feet. This part was all in loose earth and was timbered and lagged for the entire distance. The solid rock (slate) had just been reached. A force of three miners was employed, with Tom Davis as mine captain. While at the West End mine I learned that this tunnel had reached a length of 200 feet, where the vein was struck, and 50 feet of drifting done on the vein. There is 100 feet of stoping ground above the drift.

RABBIT MOUNTAIN SILVER MINE.

The Rabbit Mountain mine is situated about 25 miles southwest of Port Arthur. The road to the mine leaves Stanley on the P. A. D. and W. Ry. The property had been extensively worked years ago when in the possession of A. M. Hay of Rat Portage. The shaft was 240 feet deep and there were four levels with an aggregate of about 1,000 feet of drifting and crosscutting. The property was bought in Dec., 1898 by the Dominion Gold Mining and Reduction Company, Limited, of London, Eng., and work resumed. I visited the mine on May 8. The shaft was then 300 feet deep, with drifting in progress at the bottom or fifth level. The main vein has a strike of north 25° east, and is said to be traceable for a great distance. A large diabase dike meets the vein on the east, but does not cross it; evidently the vein is on the plane of faulting of the dike. The shaft is sunk on the vein where the dike meets it, and the best ore occurs in the dike, or close to it. The latter is found in the first four levels, but not yet in the fifth, and the drifting there is being done with a view to reaching it.

The Rabbit Mountain Junior vein is about 400 feet west of the main vein, and dips towards the latter at an angle of 45° . It is calculated that the veins would meet at a depth of 400 or 500 feet. It is the intention, some time in the future, to continue the main shaft to the junction with the hope of finding good ore. There is an old shaft which is said to be 90 feet deep on the Junior vein, but was full of water at the time of my visit. The main shaft is not in safe condition. There is a ladderway extending to the bottom, but it is not cased off from the hoisting compartment nor provided with platforms. The hoisting compartment is not fenced off at the various levels. Instructions were given to fulfil these requirements if the mine continued in operation. The hoisting machinery is in satisfactory condition. It consists of a 60 or 65 h. p. duplex double drum hoist, with grooved drums 48 inches in diameter, 1,000 feet of $\frac{7}{8}$ inch steel wire cable and steel bucket of 1,500 lb. capacity. There is a 10 drill Ingersoll compressor, four drills and a receiver 4 feet in diameter by 11 feet in length. The compressor was not in use at the time of my visit. The boiler is a return tubular of 100 h. p. capacity. There is an old mill on the property which has not been in operation since the mine was worked years ago, but it could be put into working condition without great expense. The machinery consists of a Blake crusher, Tulloch feeder, five stamp battery, two Frue vanners with four foot belts, settling pits and buddles. The mine was closed down a few days after my visit.

BLAKE AND BOSTON COPPER MINE.

On May 13 I drove out to a reputed native copper deposit in Blake township, about 30 miles south west of Port Arthur. It is known as the Blake and Boston copper mine, and was being operated by George T. Marks of Port Arthur. The only evidence of ore consisted of two outcroppings about 100 feet apart on the face of a hill. But a little blasting and excavating proved that they were only large "float" boulders, 10 or 12 feet in diameter, of amygdaloidal trap, portions of which were rich in native copper. From their angular appearance it must be inferred that their origin is not very far distant, but the country in this vicinity is so deeply covered with drift that it would be a difficult matter to find the ore in place. The formation as exposed on the face of the hill is coarse trap similar to that of the south shore of lake Superior. Richard Sandoe was manager of the mine, and four miners were employed.

PRITCHARD HARBOR COPPER MINE.

On March 22, 1900, Frank Hockley of Rat Portage gave me some notes on the Pritchard Harbor copper mine, in which he is interested. It is situated on the south

shore of Black bay, about 10 miles in a straight line from the railway, or 40 miles by boat from Port Arthur. The property consists of locations 201, 206, 207 and 208McA, aggregating 168 acres. It is owned by the Pritchard Harbor Copper Mining and Development Company, Limited; head office, Rat Portage. President, W. McLeod; vice-president, Dr. W. J. Chapman; secretary-treasurer, Frank Hockley; engineer, J. A. McAre. Work had been going on for about 4½ months with a force of 6 miners, but was suspended about the middle of March until navigation opened as the expense of getting in supplies is too great in the winter time. The work done consists of two tunnels, 20 and 22 feet long, and a shaft 31 feet deep. The ore is amygdaloidal trap, containing native copper. I saw some specimens in Mr. Hockley's office which were said to have come from there. They showed a considerable percentage of native copper.

TIPTOP COPPER MINE.

There is a copper deposit about 30 miles southwest of Savanne, which I have heard is likely to be of some importance. I have not yet visited the place, but on Feb. 20, 1900, I got some notes from F. A. Folger, who is interested in the property and was just on his way to it; it is called the Tip-Top mine. There are four locations, K61, 62, 63 and 64. It is owned by the Folger Bros. of Kingston, James Hammond and others. The ore is copper pyrites, and there is said to be a great quantity of it. Two shafts are being sunk about 700 feet apart on the vein. Work was going on at the time I met Mr. Folger.

ZENITH ZINC MINE.

There are indications of the development of a zinc mining industry on the north shore of lake Superior, in the vicinity of Rossport. One mine has been shipping during the last two winters, and test-pitting is being done on another property. I am told that prospecting operations are to be commenced on a third property immediately.

The Zenith mine consists of location 30T, which has an area of 160 acres, and is situated 13 miles north of the railway. The road to the mine leaves the railway five miles east of Rossport, at a point where a siding known as "Zinc Siding" has been constructed for the shipment of ore. Winston, a flag station 1½ miles east of the siding, is the nearest point where the regular train stops. The road to the mine is only a winter road, as 12 small lakes are crossed. This is representative of the country in all directions in this vicinity. It is extremely rough, and the shores of the lakes are all steep. It would be practically impossible to construct a summer road for any such distance. There is a continual rise from the railroad to the mine, making a total of 1,200 feet I am told. There are some long and steep hills on the road, but the slope is downward towards the railway in all instances where the hills are of any consequence, so that no great difficulty is experienced in this respect in the haulage of ore. Shipping can of course only be done in the winter. In the summer the same route is passed over to reach the mine, but on account of the number of lakes to be crossed the trip is made by canoe. The portages are all well cut out, and the time required to make the trip in the summer is about six hours. The mine is owned by the Grand Calumet Mining Company, Limited, head office, 37 Trust Building, Ottawa. President, W. J. Poupore; vice-president, P. W. Resseman; secretary-treasurer, E. L. Leetham; managing director, H. J. Beemer. The post office address of the mine is Rossport, C.P.R. The superintendent of the mine is J. E. Hoolihan; foreman, James Whalen; foreman of cobbing table, Frank McPhee. Total force, including teamsters, cobbers, etc., eighteen.

I visited the property on February 21st, 1900. The snow being deep, I could not examine the vein, and as no mining was going on at the time the shafts were full of snow. The formation is coarse trap. I was told that there are two veins, one of which can be traced for a long distance. Three shafts had been sunk; No. 1, on the junction of the veins, 35 feet deep; No. 2, 40 feet deep; and No. 3, 12 feet. There was also a small open cut from which about 100 tons of ore had been taken. This is all the mining work that has been done on the property.

It appears that although the vein is continuous on the surface, and presents a good showing at places, the ore does not extend to any depth, although the depth is variable at different points along the vein. The consequence of this is that the mining will con-

sist of making a series of open cuts or pits along the vein. I do not know to what extent this rule applies; it may be very local. The ore of the Zenith is pure zinc blende, dark in color. In the vein it is mixed with a certain proportion of country rock which is separated by cobbing. When I was at the mine the only work going on was cobbing and shipping of ore which had been mined during the previous summer and spring. The ore was conveyed to a roughly but substantially constructed platform, known as a "cobbing table." It is there broken by sledges into pieces the size of a hen's egg. A double purpose is served by this process; the barren rock is all removed, leaving pure zinc blende, and the ore is rendered more convenient for shipping. It is packed in canvas bags containing 125 pounds each. Five teams are employed in hauling the ore to the railroad, a distance of 13 miles. Each team makes one complete trip per day and takes from $2\frac{1}{2}$ to 3 tons per load. Thus the cost of transportation from the mine to the railway amounts to about two dollars per ton, which is not a serious matter for ore that is so valuable as this. It is not at all probable that the cost will ever be reduced unless it is found there are very great quantities of ore, as the cost of building any kind of a railroad through such a country would be prohibitory. This property was originally discovered and taken up by the McKellar Bros. of Fort William about 20 years ago, but was not worked with a view to shipping ore until the winter of 1898-99. It was then owned by H. J. Beemer, the managing director of the present company. Mining and shipping were carried on from Jan. 16 as long as the roads were good, and after that mining was continued for a few weeks. The present company bought the property from Mr. Beemer and is endeavoring to sell again, as it intends to work a zinc-lead property on Calumet island in the Ottawa river. If the company do not sell mining operations will be continued during the coming summer. The buildings at the mine consist of boarding camps for the accommodation of 40 men, office, stables and powder house, and stables and camp at the railway. Machinery consisting of boiler, hoist and two steam drills was brought in last winter but never installed. Instructions were given to fence all shafts.

GESIC ZINC MINE.

The Gestic mine is about two miles south of the Zenith, on the same road. There are ten locations, aggregating 400 acres. The owners are W. A. Johnson, C. Palmer and J. Hare of Toronto, who are forming a stock company to take the property over; F. W. Easton is manager of the mine. I visited the property on Feb. 22 while returning from the Zenith, and found operations in progress on location ES79. A test shaft with a dip of 50° or 60° north had been sunk 23 feet on the vein and was being continued. The formation is trap; the vein is said to be traceable over several locations, with a strike of east and west. At the surface of the pit there is very little mineralization; in fact the vein appears to consist of only a sheared zone of country rock. But at the bottom of the shaft zinc blende is making its appearance in promising quantities. A force of four miners was employed. Work had been going on since the latter part of Nov., 1899.

I understand that a discovery of zinc has been made at Mazokama on the C.P.R. west of Rossport, and that prospecting operations have commenced.

IRON ORE LOCATIONS.

Prospecting operations on iron locations are being conducted at several points east and west of Port Arthur, but I have not visited any of these places.

In September last a trip was made on the P. A. D. & W. railway to a location a few miles from Gunflint, where it was reported a very valuable iron deposit had been discovered, but on examination it proved to be too much mixed with greenstone to be of any value. Appearances however were encouraging, and possibly valuable deposits will be found in the vicinity.

Mr. A. M. Wiley of Port Arthur informed me that he and his brothers own 1400 acres of land containing valuable deposits of iron ore about 12 miles up the Pic river, near Peninsula harbor. The ore is said to outcrop on the banks of the river. It is free from titanium, and contains only a very small percentage of sulphur and phosphorus. Diamond drilling will be done on the property immediately.

A tunnel is being driven through a mountain of iron ore on the Atikokan, which is famous for its iron deposits. I have not yet visited the place.

It is reported that prospecting operations are to be commenced immediately on a property about 30 miles east of Port Arthur.

On the Mattawin river, west of Port Arthur, the Government diamond drill is at work on a number of large deposits.

It is altogether likely that prospecting for iron will be carried on vigorously during the coming summer.

REDUCTION WORKS.

Reduction works for the treatment of gold ores are in operation in the vicinity of Rat Portage, but are doing only a limited amount of work.

RAT PORTAGE REDUCTION WORKS.

The Rat Portage Reduction Works were held under option by A. B. Upton of Duluth for a short period, but have reverted to the owners. The works have been recently engaged in treating a lot of 215 tons of ore from the Wendigo mine, and are open for business.

NORMAN REDUCTION WORKS.

The Norman Reduction Works, which were being erected by the Canadian Gold Extraction Company, Limited, under the superintendence of R. H. Ahn, were never completed.

KEEWATIN REDUCTION WORKS.

The Keewatin Reduction Works have only been in operation about one-third of the time during the year, but the assay and testing departments have been kept fairly busy always. The summer is much the busier season. Most of the ore comes by water from the Lake of the Woods mines, but a reasonable proportion comes by rail. No change has been made in the plant. The jigs have been completed and work satisfactorily. There are two of these, with three compartments each. The first compartment has about $\frac{1}{8}$ inch stroke and the other two decrease in succession. Iron pyrites is used for bedding. Lately the operations of the works have been directed towards doing test work in cyaniding and concentration of ores. This work is done chiefly on ores from British Columbia and from the Sudbury region. The testing is for the purpose of ascertaining the proper kind of plant to install. A small jig, a plane table, etc., have been installed for concentration testing, and a series of small vats for cyaniding. Chlorination testing can also be done in the laboratory. During the summer a total force of eight is employed, including the manager, W. J. Craig, the assayer, H. A. Guess, and the mill superintendent. The last mentioned position is vacant at present.

MINES OF EASTERN ONTARIO

By Courtenay De Kalb, Inspector

The past year has witnessed a great increase of activity in the mineral industry of Ontario, and the prospects for the future are very encouraging. Doubtless some of the new operations will prove to be ephemeral, but in the main there is a substantial improvement in the situation. Some of the properties which appear to be in danger of suspension have been brought into their present state of embarrassment through incompetent management. It is most unfortunate that the difficult operations of development should so often be entrusted to men whose knowledge of mining is totally inadequate for undertaking such responsibilities. As I pointed out last year, there is a very general tendency to incur unwarrantable expenses in the equipment of mines in Ontario which are but little more than prospects. The progress of the industry in the Province would be enhanced by greater caution and economy in the initial stages in mining work.

The growth of the iron industry continues to be retarded by the efforts to produce ore to meet expenses before a sufficient amount of development has been done to render economical and steady operations possible. The same criticism will apply to most of the gold properties in the eastern district. The stone industry is apparently less flourishing than in former years, but is decidedly better than in 1898. Many new quarries are now being opened, and extensive operations are projected at the Forks of the Credit. There is also increased activity in the cement industry. New plants are being erected and old ones are being enlarged, while additional companies are being projected.

The mining methods pursued in the Province are very generally faulty, as was pointed out in my last report. A most efficient remedy would consist in establishing a system of licensing foremen, upon suitable demonstration of fitness. Not only would this soon result in more economical mining and in a general improvement of the condition of the mineral industry, but it would also lessen the number of accidents, which are becoming exceedingly frequent as a result of both ignorance and carelessness. The adoption of such a system would be in the interest not only of the owners of mining properties, but of the miners themselves.

GOLD MINES.

The greatest activity in gold mining in the eastern district of Ontario during the year 1899 was in the counties of Hastings and Frontenac, although prospecting has been carried on in many places in the western part of the district, and one mine (the Ophir), which had lain idle for a number of years, has been reopened and is now undergoing further development. Properly speaking, all the gold mines in the district are in a state of development, so that their operations are more or less tentative. A considerable number of the companies and syndicates interested have adopted the policy of erecting ten-stamp mills and milling the output of ore obtained in the process of development, so that they appear as producing mines. This policy has proven a wise one in a few instances, but in others it has been adopted, in imitation of the procedure of well-administered properties, when there was insufficient millable ore in sight to warrant the expenditure for such a plant. The tendency is very general to undertake production before enough development has been done to insure permanent operations, and the consequent irregularity of working seems to discourage capital and to raise a prejudice against gold mining in this district. It is to be hoped that in future more systematic and thorough development of the properties will be prosecuted before milling plants are erected, so that when production is begun it may be continued without interruption.

OPHIR MINE.

The Ophir mine was operated for a short period beginning in 1892. A twenty-stamp mill was erected and a pumping plant was established on the shore of lake Ickta, about 200 yards distant, for supplying water to the mill. The water-supply system has been

dismantled, but the mill has been preserved in good condition. It stands 411 ft. w. s. w. from the tunnel entrance to the mine, this being originally begun as a drift mine. The mill foundations measure 58 ft. by 81 ft., with a wing 37 ft. by 46 ft. for the power plant. The battery floor is 37 ft. by 58 ft., above which stands the rock breaker. The power plant consists of two 60 h.p. boilers and a 75 h.p. Reynolds-Corliss engine. A gravity tramway leads from the mine to the mill. The hoisting plant in use at the mine was a 16 h.p. duplex hoist, taking steam from a 12 h.p. upright boiler. Diameter of drum, 18 in.; cable, $\frac{1}{2}$ in. in diameter. This stands 60 ft. s. w. of the shaft. The other surface accessories are a blacksmith shop, office, boarding and lodging houses, at varying distances south of the mine. The dynamite magazine was located 400 ft. from the mine and 150 ft. from the buildings. Instructions were given to remove this magazine to a distance not less than 600 ft. from the buildings, roads, or other places where workmen might habitually congregate or pass, which has been done according to advices received from the manager. The gravity tramway has also been repaired and made secure, in accordance with instructions.

The mine as it existed at the date of my visit (Sept. 2, 1899) consisted of a large irregular stope at a very flat angle (averaging about 45°), inadequately sustained by pillars left near the surface, and by stulls of such small diameter, and so poorly set, as to offer but little resistance. The hanging wall was exceedingly dangerous, and roof-falls were common. The size of the stope was approximately 50 ft. x 150 ft., with a winze near the middle, and an incline at the s. w. end, now used as a sump and pump station. Sinking was in progress in the winze, which was being deepened from an original depth of 14 ft.

About 50 ft. s. e. from the mouth of this stope is an old shaft, 78 ft. deep, which was being timbered preparatory to sinking.

The plan proposed for safely working this mine, approved after a few modifications which are incorporated herewith, is as follows:—Sink the shaft to a depth of 100 ft., and drift on the vein from that point, under the old workings. Then to upraise into the old workings for air, but to make no other opening into the old stope. In order to prevent danger to the new workings below from the collapse of the roof in the open chamber or stope above, cribs are to be built about one-third of the distance from the bottom of the stope to sustain the hanging wall, which wall is then to be shot down, sorting out any ore therefrom and filling the waste into the lower part of the old stope between and below the cribs.

The owner of this property is Mr. Peter McArthur of Toronto. It is being operated on a working bond by a syndicate consisting of Messrs. E. L. Sawyer and E. Strachan Cox of Toronto, under the management of Mr. F. A. Fenton of Bruce Mines, with Mr. H. F. Downing as superintendent of mines. The number of workmen employed was 9 below ground and 6 on the surface. The location of the property is the south half of the north half, and the north half of the south half of lot 12, concession 3 of Galbraith, district of Algoma. The region is one of considerable geological disturbance, with many dikes of basic intrusives, apparently belonging to the same period of volcanic activity as that which resulted in the conditions leading to deposits of copper ores between this point and lake Huron at Bruce Mines. The Ophir deposit is associated with a dike of highly basic intrusive rock, with which, for a short distance at least, it is in direct contact. The ore deposit itself consists of quartz associated with chlorite schist, with diorite on the footwall. Further investigation of the geology of the deposit was impossible in the short time at my disposal.

DELORO MINES.

The Deloro mines, owned by the Canadian Gold Fields, Limited, have made notable progress within the past year, both in the establishment of a successful plant for gold extraction and arsenic recovery and in underground development. In detail, the extension of underground workings is as follows:—Gatling shaft deepened from 192 ft. to 341 ft., the depths to the levels being, from the surface to 1st level 70 ft., to 2nd level, 133 ft., to 3rd level, 233 ft., to 4th level, 333 ft. The Tuttle shaft has been deepened 5 ft. to 127 ft. A number of new shafts have been sunk for development of the deposit as follows:—Keswick D, situated 1250 ft. n. $8^\circ 50'$ e. from Gatling shaft, inclination 52° depth 50 ft. 6 in.; Keswick E, situated 1740 ft. s. 8° w. from Gatling shaft, vertical,

depth 29 ft. 6 in.; Keswick F, situated 1320 ft. s. 2° e. from Gatling shaft, inclination 10° , depth 50 ft.; Hawkeye No. 1, situated 1265 ft. n. $3^{\circ} 30'$ w. from Gatling shaft, inclination 32° , depth 165 ft.; Hawkeye No. 2, situated 1320 ft. n. 2° w. from Gatling shaft, inclination 55° , depth 42 ft. 6 in.; Gatling west crosscut—Vein shaft, situated 200 ft. n. 72° w. from Gatling shaft, inclination 60° , depth 53 ft.; Guyline shaft, situated 360 ft. s. $23^{\circ} 30'$ w. from Gatling shaft, inclination 82° , depth 47 ft. The changes in levels have been, in Gatling level No. 3 south, 257 ft. advance; in Gatling level No. 4 south, 33 ft. 6 in. advance. Gatling crosscut west has been continued 106 ft., giving a total length of 356 ft.; Tuttle crosscut has been advanced from 40 ft. to 94 ft. Gatling west crosscut level has been carried north 88 ft. and south 112 ft. A raise is being driven in this level to connect with Gatling west crosscut Vein shaft. Additional work has been done in the air drift and in the Tuttle crosscut level. The size of the stopes at present is approximately as follows:—1st level, south of Tuttle shaft, length 80 ft., height 21 ft.; north from same shaft, length 80 ft., height 40 ft. A rib or pillar has been left in the north end of the stope 15 ft. above the level, 45 ft. by 30 ft. South of Gatling shaft, beginning beyond the shaft pillar (18 ft. from shaft), is a large stope 310 ft. long and varying from 10 to 50 ft. high, which is now more than a third full of stowage, sent down from the surface. North of Gatling shaft beyond the shaft pillar is another stope, 55 ft. long and from 10 to 25 ft. high. The 2nd level stopes are: South from Tuttle shaft, beginning 8 ft. from shaft, length 60 ft., height 48 ft., with a 10 ft. x 10 ft. pillar at mid-distance; south from Gatling shaft, length 390 ft., height 63 ft., one-third filled with waste rock, and sustained by two waste pillars, one at the north end 60 ft. x 20 ft., and another at mid-distance 20 ft. by 25 ft., and by 8 smaller pillars. The 3rd level stopes are: south from Gatling shaft, beginning 70 ft. from shaft, length 170 ft., height from 5 to 15 ft., working in 5 ft. cuts. The character of the walls is such that but little timbering is required. In the older upper portions of the mine, where the rock was weakened by atmospheric agencies, the stopes are being systematically filled with waste rock, and such timber as remains is being drawn and the walls secured by rock-filling. The shaft timbers and skipway in Gatling shaft have been carried down to the 3rd level.

The new mill, which was described in my last report, has been in operation since January, 1899. Meantime the old mill has undergone extensive repairs, and has been converted into a works for arsenic recovery only. The concentrates after treatment by bromo-cyaniding are dried, and then roasted in a revolving cylinder roaster. The fumes are condensed in a series of brick chambers with vertical baffle-walls. A new set of vertical galvanized-iron condensers of cylindrical form is being erected at the n. w. corner of the arsenic works. The fumes are collected from the condensing chambers and refined by re-roasting in a special form of reverberatory furnace, the fumes being condensed in a second set of brick chambers. Separate, securely sealed rooms are set apart respectively for bolting the arsenic and for packing. The arsenic is packed in kegs by the aid of an automatic jumper, and all kegs are plainly labelled and cleaned for shipment. A double wash-room is provided for the workmen, one part for clean clothes and the other for the clothing to be worn in the works. No arsenic fumes were observed in any part of the plant, and due precautions were observed to protect the employees. Antidotes are maintained constantly available in case of poisoning, and at least one man on each shift is fully instructed in their use. A physician is always at call by telephone. Owing to the tentative character of the operations at this mine in the past, no objections had been made to the present site of the explosives magazine, which is in dangerous proximity to the mine and surface plant. Instructions have now been given, however, to build a new magazine, of lighter construction than the old stone one, at a distance of at least 400 ft. from any works or roadway, properly guarded by a mound or other protective rise of ground, to be completed by June 1, 1900. Instructions were also given to provide hydrogen peroxide and hypodermic syringes for use in case of poisoning in the cyanide works. The manager of the mine is Mr. P. Kirkegaard.

Prescott, of Cleveland, Ohio. The property consists of a tract known as "The Gatling Five Acres," surrounded on all sides by the lands of the Canadian Gold Fields, Ltd., about one mile from Marmora station on the Central Ontario Ry. The underground workings consist of two shafts. Shaft No. 1 is located 250 ft. s. s. w. of the mill, and has a depth of 85 ft. At a depth of 78 ft. the first level has been driven, extending n. e. 120 ft. and s. w. 100 ft. Stopping has been commenced in the northeast dr.ft. Shaft No. 2 is 100 ft. s. e. of the mill and is 60 ft. deep. This at present is not working.

At shaft No. 1 a skeleton head frame 25 ft. high has been erected. Hoisting is done in a skip, using a $\frac{3}{4}$ in. cable, wound on an 18 in. drum on a portable hoist. The hoist and vertical boiler are all on one bed-frame, and are housed in a temporary shed-adjacent to the head-frame. The mill contains ten stamps, one 7 x 10 in. Blake crusher, a Frue vanner, and a Wilfley table. This plant was installed by the Wm. Hamil on Mfg. Co. of Peterboro, Ont. A 3-rail inclined plane tramway brings the ore from the mine to the mill, a distance of 170 ft, with a total lift of 40 ft. The dynamite magazine is located 400 ft. e. s. e. from the mill behind a low eminence. Instructions were given as to proper cleanliness in the dynamite magazine, as to the proper use of the dynamite hot water thawer, and as to proper protection by guard rail around shaft-mouth.

THE BELMONT MINE.

Since the last inspection this property has been purchased by the Cordova Exploration Company, Ltd., of Newcastle-upon-Tyne, England. The rights acquired are 300 acres in fee simple in Belmont township, Peterboro county; 125 acres of mineral rights only in Marmora township, Hastings county, contiguous; and 160 acres, including a valuable waterpower on Deer river, at the outlet of Deer lake, 2 miles n. w. of the mine. Since the acquisition of this property, after prolonged testing by the Cordova Exploration Co., extensive preparations have been made for permanent operations at this mine, and it is proposed to erect a large air compressor plant at the Deer river falls, where an effective head of 90 ft. is available, the air to be piped to the mine for use in all situations where power is required. A large electric plant is part of the projected improvement, and it is probable that current will be transmitted to Deloro for electric lighting at that plant.

In the scheme for underground work ten shafts are enumerated, of which No. 4 and 5 are closed, 8 and 9 are located but not sunk, and No. 1, 2, 3, 6, 7 and 10 are being operated. Shaft No. 1 has been deepened from 135 ft. to 250 ft., and is still sinking. The manager, Mr. D. G. Kerr, has adopted the plan, new in Ontario but common in the large mining centres of the West and South, of carrying the timbers and skipway close down to the bottom of the shaft, and using telescope rails for the remaining 6 to 10 ft., so as to hoist from the bottom while sinking. In blasting he uses the side cut, shooting to the foot wall, with 4 unkeying shots, with a line of least resistance of 3 ft. 3 in., and 3 sticks of 50 per cent. dynamite to each hole. Including key and following shots, 25 holes $1\frac{1}{4}$ in. diameter are employed for each 3 ft. 3 in. cut, the cross-section of the shaft being 16 ft. x 9 ft. The work is so skillfully done that no injury has ever been sustained by the timbers or skipway. The work of sinking has been greatly cheapened and facilitated since the introduction of this system. It is doubtful if a better example of scientific blasting has ever been seen in Ontario.

Shaft No. 2 has been deepened from 35 to 95 ft., and connected by levels with shaft No. 3. The latter has been carried down from 40 to 185 ft. Shaft No. 6 (new) has reached a depth of 85 ft. It is located 750 ft. n. e. from shaft No. 1, and has an inclination of 75° to the s. w. The cross-section is 12 ft. x 8 ft. It is single compartment with a manway. The hoisting works consist of a head-frame, 12 ft. x 14 ft. at base, and 20 ft. high to the sheave block.

Shaft No. 7 (new) is 425 feet north of shaft No. 1. It is vertical, 80 ft. deep, cross-section 16 ft. x 9 ft. The hoisting works consist of a closed head-frame 17 ft. x 35 ft. at base and 35 ft. high. It is provided with a 30 h.p. double drum hoisting engine, actuated by compressed air piped from the central air compressor plant.

Shaft No. 10 (new) is 560 ft. east of shaft No. 1. It is inclined 75° to the south, is 35 ft. deep, and has a cross section of 14 ft. x 10 ft. Hoisting is still being done by windlass.

The new levels are as follows: In shaft No. 1, at a depth of 200 ft., east drift 50 ft., west drift 50 ft. A pump station has been established near the shaft on this level, over a large sump 15 ft. deep, with a cross section of 15 ft. x 9 ft. The pump is a Northey duplex direct acting, with a capacity of 250 gallons per minute. The motive power is compressed air at 85 lb. pressure. From shaft No. 2 the 50 ft. level extends 260 ft. n. w., and 110 ft. s. e. to shaft No. 3. The 90 ft. level extends 260 ft. n. w., and 110 ft. s. e. to shaft No. 3. From shaft No. 3, in addition to the 50 ft. and 90 ft. levels from shaft No. 2, is a level at 185 ft. extending 250 ft. n. w., with an upraise, started at a distance of 110 ft. from the shaft to connect with shaft No. 2 above. From shaft No. 7 at a depth of 75 feet., is a level drifting n. w. 20 ft. and s. e. 65 ft.

A new shaft house has been erected over shaft No. 3, having foundations 18 ft. x 35 ft., and a height of 30 ft. A 30 h. p. double drum hoisting engine is being installed, which will use compressed air as a motive power. The tramway from the mill to shaft No. 1 has been extended to No. 7 shaft, and will be continued around to shafts No. 6, 2, 3, 5 and 10 in the order named. The old mill adjacent to the No. 1 shaft house has been made over into a machine shop, and above this, on the same level as the shaft mouth, is a new blacksmith shop. The air compressor plant installed by the Rand Drill Co. is located 400 ft. e. n. e. from the mill, on lower ground than the other works, insuring perfect drainage of leading pipes. The building is of wood, 40 ft. x 60 ft., with boiler room attached. The compressor is of the latest model, cross compound, both steam and air. The indicator showed high pressure steam, 125 lb., low pressure steam, 25 lb., high pressure air 85 lb., and low pressure air 20 lb. Steam is derived from 2 return tubular, 70 nominal h.p. boilers, using water from the coolers and fitted with electric damper regulators.

The explosives magazine is located 600 ft. south of shafts No. 2 and 3, and 450 ft. east of the air compressor plant. Protective mounds insure reasonable safety. It is well constructed of wood with steel shingled sides, the expediency of using which is, however, questionable. The practice of storing caps and fuse in the same building was objected to in this case as in all others.

The only addition to the milling plant consists of a Fraser and Chalmers ball pulverizing barrel for regrounding the stamp mill tailings for reamalgamation. A new carpenter shop has been erected 300 ft. s. e. of shaft No. 1, consisting of a 2 storey building, 24 ft. x 40 ft. on the foundations. A residence for the staff and a new office and warehouse have been erected also. Instructions were given to board off all manways from hoisting compartments in shafts, and to put up the signal code at all landing stations and in engine rooms.

BOERTH MINE.

This mine has come into prominence within the year as a producer of bullion, and development work is being actively prosecuted. Its prospects were for a time seriously crippled by an unfortunate experiment with a new process for the treatment of its ores, but a mill has now been erected which is claimed to be successful, and which proves that the ore presents no difficulties which are not well understood by technical men. The property is situated in Clarendon township (lot 28. 7th concession), in Frontenac county, about 12 miles west of Clarendon station on the Kingston and Pembroke Ry. The corporation is known as the Boerth Mining Company of Ontario, Ltd., with its head office in Windsor, Ont. The president is Henry J. Boerth, vice-pres. Abraham Maymount, and sec. and treas. Alex. J. Groesbeck, all of Detroit, Mich. The manager was C. O. Groesbeck (since superseded). The ore extracted has been chiefly by surface stripping and open cut work. One development shaft has been sunk to one side of the main lode, following an off-shoot of the vein. This is known as the Hattie B. shaft, and has an inclination of 65° to the s. w. Its depth was 120 ft., with a cross section of 8 ft. x 11 ft. At a depth of 75 ft. a level has been opened out, drifting south 28 ft. and north 25 ft. Hoisting is done with a barrel on a skidway. A ladderway is provided, without sollars, and not boarded off. The shaft house is 20 ft. square on the base and 32 ft. high. The hoisting engine house is 40 feet south of the shaft. A derrick hoist is used, with 6 in. x 8 in. cylinders, taking steam from a 15 h. p. marine boiler. The Uncle Sam shaft is located 160 ft. south of the Hattie B. shaft. This was full of water, but was said to be 35 ft. deep. Its cross section is 7 ft. x 14 ft. The mill is located 1700 ft. east of the

Hattie B. shaft. It was furnished by the Jenckes Machine Co. of Sherbrooke, Que., and contains one 7 in. x 10 in. Blake crusher, 10 stamps of 900 lb. each, with Challenge feeders, and 2 Wilfley tables. In an adjacent structure is the power plant, consisting of a 30 h. p. engine and a 35 h. p. boiler. Dynamite is stored in a magazine 800 ft. distant from the nearest buildings or workings. Thawing is done in a horizontal tubular thawer (Ontario Powder Co's model) in a separate building 100 ft. from the boiler house and 150 ft. from the mine mouth. Other buildings are an office, two lodging houses, blacksmith shop, and stable. Instructions were given as to complying with the regulations of the Ontario Mines Act concerning manway and protection of shaft mouth by guard railings.

COPPER AND NICKEL MINES.

The past year has shown but little increase in the exploration for copper, judging from the circumstance that almost no prospecting has been reported from regions where outcropping cupriferous veins are known to exist, as, for example, in the belt north of Thessalon and Bruce Mines where only one lode has been exploited, and in the eastern portion of the Province where a number of outcrops have locally attracted attention, but have not led to any development work save in the vicinity of Coe Hill. This is somewhat surprising in view of the prevailing high prices for copper. The inactivity in the east has been offset by a marked revival of prospect and development work in the Sudbury copper-nickel district. The amount of ore placed in sight by these works has, however, not yet attained any very considerable proportions. One property suffered collapse from a hasty and ill-considered experiment with a new process, and in two cases the Canadian Copper Company also committed the error of erecting expensive plant on new prospects which subsequently proved to offer no basis for permanent operations. The tendency in the copper-nickel district to undertake the installation of expensive plant in advance of a proper development of the mines is quite as noticeable as in the case of the gold mines of the Province.

BRUCE MINES.

At the time of my visit (Sept. 1, 1899) definite advices as to the expected change of ownership of this group of mines had not been received. The resident manager was Mr. George H. Trethewey. The mines described in my former report were still kept unwatered, and all instructions to insure safety had been scrupulously followed. The old Copper Bay mine, the scene of a serious disaster from a roof collapse many years ago, had been pumped out and was carefully inspected throughout. This mine, entered by the Bray shaft, is on a northwest extension of the Wellington vein, 350 ft. from the nearest shaft of the group previously described. This portion of the property, embracing 6400 acres, has been purchased by the Lake Huron Copper Syndicate, Ltd., of No. 31-33 Palmerston Buildings, Old Broad St., London, E. C., England. The shaft is 429 ft. deep, single compartment with manway, through which also pass the old Cornish pump rods and pump column, and the new pump column. The timbers, as might be expected in a mine containing copper pyrites, full of water, are well preserved. The ladderway is also sound.

There were 5 levels in the mine, drifting n.w. and s.e. from the shaft. Those to the n.w. led into a series of stopes, which were largely filled at the time of the collapse of the mine. The 1st level has been practically obliterated. The 2nd level, n.w. drift, is inaccessible on account of the debris. The s.e. drift leads into a series of old stopes, one running nearly east and west, the other, known as the "Fire Lode," running nearly n.n.w. The east and west cross-stope is continuous down to the 4th level, having only one floor-arch in place. Portions of the old level-floors on stulls still remain, and are in a dangerous condition. A drift continues westward beyond the stope a little above the 3rd level, and a winze at the east end leads down to a drift on the 5th level. There is also a connection between this stope and the Fire Lode stope. The 3rd level opens s.e. into the above-mentioned stope, and is filled with debris toward the n.w. in the caved portion of the mine. On this level is a pumping station, with a 9"x10"x5"

duplex direct-acting pump, made by Smith of Toronto. On the 4th level the n.w. drift and stope is more open to inspection, and on the 5th level it is possible to pass around the caved material for a distance of 243 feet. The depth to this level is 360 feet. The shaft below is full of water. A 10"x10"x5" pump is stationed on this level. Toward the s.e. the drift is open 75 ft. to the old sump, which is directly under the winze from the 4th level. Beyond this point the drift is inaccessible. The walls throughout show no signs of weakness, nor any tendency to scale. The accident causing the loss of this mine was due to the falling in of the roof, or cap rock, between the 1st level stope and the surface. The thickness of this cap-rock averaged 30 ft., with a span of about 40 ft. across the stope. The slip occurred along a seam between the lode and the hanging wall. In various places throughout the Wellington lode true slickensiding is observable on the hanging wall, and this constituted a line of weakness. The grooving is nearly horizontal, indicating a shear fault, which has been occasioned by the intrusion of a dike of basic eruptive rock that has distorted the country rock over a large area, causing lateral movement along joint planes and opening up fissures on the joint planes crossing those along which movement occurred. The quartz vein-matter has been deposited along these opened joint planes, forming a complicated network of veins and veinlets. The structure of the rocks surrounding the more important veins or lodes has consequently been weakened originally, but the vein-filling is for the most part so closely adherent to the enclosing rocks as to re-cement the walls, rendering them sound. This is particularly true as to the cross veinlets, but is not true of those walls which were slickensided. Hence the weight of the cap rock was sustained almost entirely by the grooving in the walls, and as this plane of division between the vein-capping and the hanging wall was inclined in the same direction as the open stope beneath it was only a question of time when it must have given away. The case is instructive as showing the importance of a careful inspection of fissure and joint planes in cap-rock and floor-arches which in circumstances like this involve greater peril than stripping of the vein to the surface. The effect of the slip was to break through all floor-arches and stulls below to the 5th level, and only the narrowing of the stope between the 4th and 5th levels prevented the free fall of debris to the bottom. This accident, according to tradition, was unattended by loss of life, as the slip fortunately occurred between shifts, at a time when no employes happened to be in the mine.

ROCK LAKE MINE

The Rock Lake mine is situated about 12 miles north of Bruce Mines, the holdings of the company comprising the n. half of lot 2, concession 6 of Plummer, the n. half of lot 3, same concession, s. half each of lots 2 and 6, and all of lots 3, 4 and 5, concession 1 of Coffin, district of Algoma. The corporation has the title the Rock Lake Mining Co., Ltd., with the following officers: President, M. Wile, Buffalo, N.Y., secy., L. O. Holden, Sault Ste. Marie, Mich., treas., B. C. Ooryell, Chesaning, Mich., gen. mgr., Arthur S. Burrows, Bruce Mines, Ont. The mine captain was Joseph Nullon and the number of workmen was 43 (Sept. 2, 1899). The ore consists of chalcopryite, disseminated through a quartz gangue with hackly fracture, occurring in diorite, with a wall rock of altered diorite, having a resemblance to slaty structure. The trend of the lode is approximately w.n.w., bearing in the direction of a dike of dark eruptive rock apparently but little less acid than the diorite, through which it was intruded. The dike is from 150 to 200 ft. in width, and contains a very large proportion of diorite inclusions. The distance from the mines to the dike is about 1,200 ft. There is doubtless some genetic relation between this dike and the copper-bearing lode, which, however, time did not permit of my working out. There appeared to be a very close resemblance between the geological setting of this deposit and of those occurring at Bruce Mines. The underground workings consist of the following: A shaft 500 feet s.w. of the public road on lot 2, concession 1 of Coffin. The shaft is vertical, 9 ft. x 16 ft. in cross section, with 2 compartments 5 ft. x 7 ft. in the clear, and a manway 4 ft. x 7 ft. in the clear. Depth of shaft 168 ft. At a depth of 103 ft. a crosscut of 6 ft. has been driven to the vein, on which drifting has been done 48 ft. southeast and 49 ft. northwest. A tunnel has been driven on the other side of the ridge, 80 rods s.e. from the shaft, on lot 2, concession 6 of Plummer. The tunnel is 7 ft. x 7 ft. in cross section and 170 ft. long. In addition

there are numerous trenches and open cuts on other parts of the lode. The surface plant consists of a shaft house 18 ft. x 20 ft. base and 25 ft. high. Hoisting is done with kibble, to which on my recommendation a cross-head was added. A trestle extends 200 ft. from the shaft house to the dump. The power house is located 150 ft. n.e. from the shaft. The structure is 40 ft. x 50 ft. on the foundations and contains 2 rooms, one for boilers, with 2 return tubular 80 h.p. boilers, the other containing a duplex hoisting engine with 24-in. drum, winding a $\frac{3}{4}$ -in. cable and a 10-drill duplex Rand air compressor. Other buildings are a boarding house, lodging house and stable. The main dynamite magazine is a wooden building at the mouth of the tunnel, this tunnel being now abandoned. A small shed 400 ft. s.w. of the shaft is used for the day's supply of dynamite. Instructions were given to post up the signal code and to prohibit men from being raised or lowered in the kibble.

The Grand Portage mine, north of Thessalon, was closed down and hence was not visited.

COPPER CLIFF MINE.

This and the following seven mines are properties of the Canadian Copper Company. The new work done at the Copper Cliff since last inspection is as follows: The shaft has been sunk to the 12th level and 35 ft. below. Distance from 11th to 12th level 68 ft. on the incline of the shaft. Present depth of shaft, 886 ft., 10 in., being an increase of 76 ft. A drift has been started in a westerly direction from the shaft, which will meet the winze formerly sunk from the 11th level. The drift is now 39 ft. long. On the 11th level the n.w. drift has been extended from 42 to 70 ft., and the s.e. drift has been lengthened from 100 to 111 ft. Ten feet from the old stope on the n.w. drift, is a new stope 23 ft. high, 50 ft. long and 15 ft. wide. Sixty-five feet from the old stope on the s.e. drift is another new stope, 56 ft. high, 46 ft. long and 27 ft. wide.

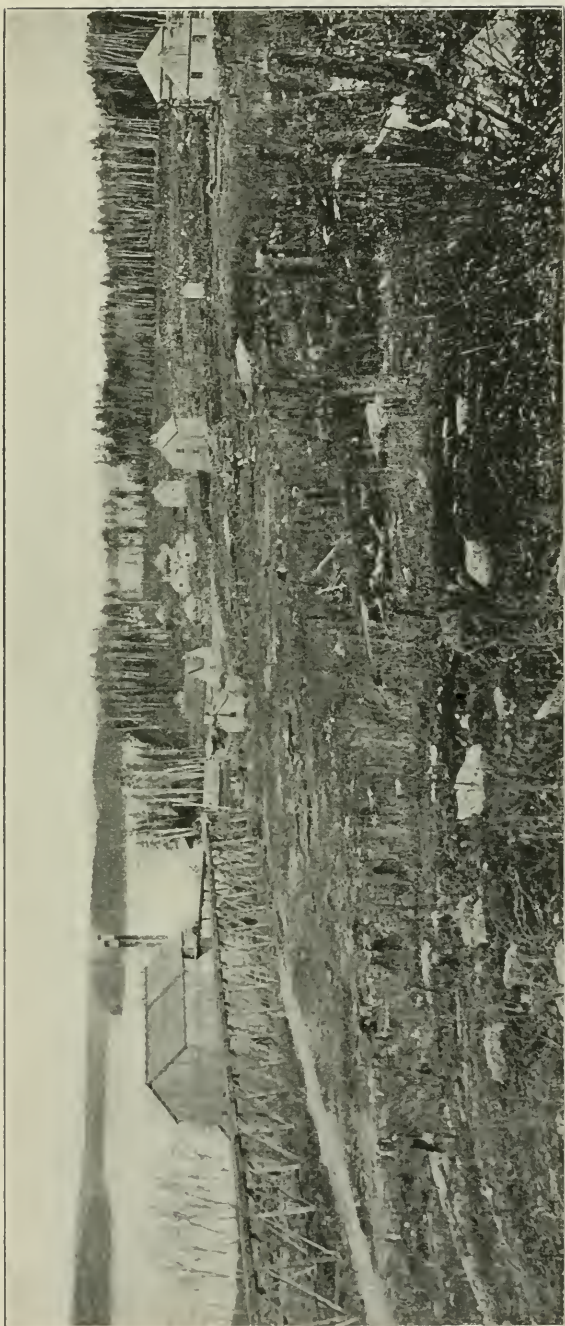
On the 10th level, s.e. drift, is a new stope 51 ft. long, widening from 13 ft. to 14 ft., with a height of 34 ft. No further changes have been made in the mine since last inspection. Instructions given were to bar off the 8th level crosscut; prohibit the use of abandoned workings for the personal convenience of the men, providing suitable sanitary arrangements near enough to their place of work to be available; block up the timber under the 8th level collar more securely, and post up signal code below ground.

EVANS MINE.

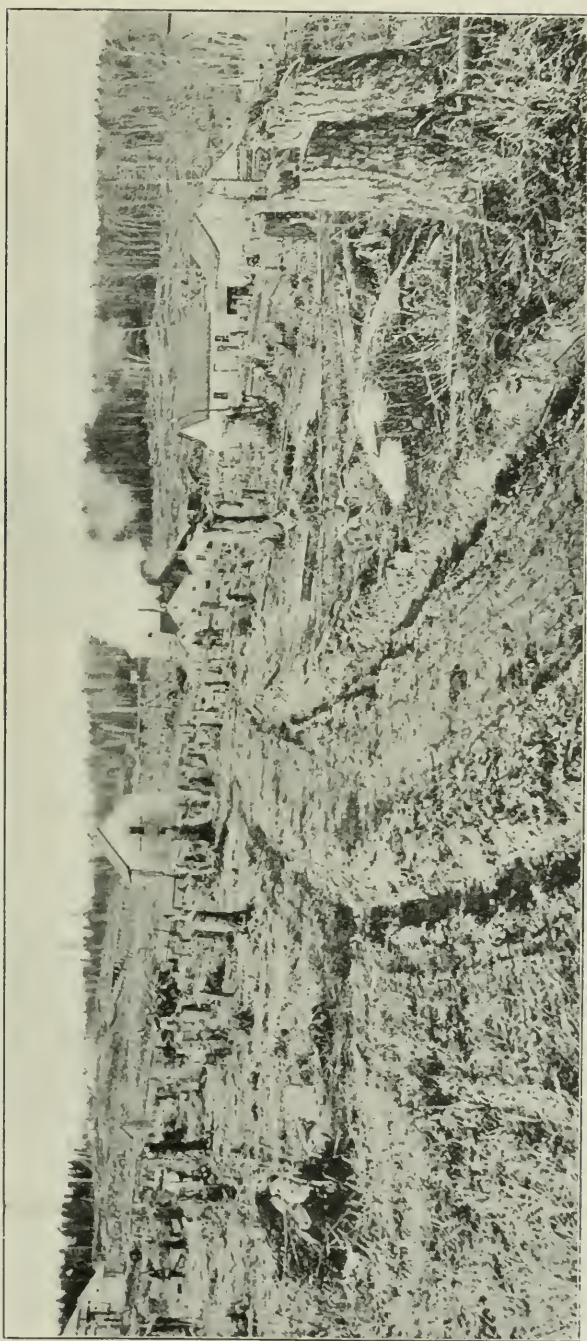
This mine has been stripped down to the 5th level, with the exception of a small rib of ore constituting part of the old pillar between the 4th and 5th levels, which it was expected would be removed within the next 8 weeks, (after Sept. 6, 1899). In all other respects the mine and plant remain unchanged. No guides had been provided for the cross head down to the bottom as required by a previous order. In view of the small amount of work remaining to be done before the abandonment of this mine, and because the danger of accident from oscillations of the kibble has been lessened by the removal of the old floor arches, permission was granted to continue hoisting by the present method until the aforesaid rib shall have been removed. But further hoisting by this method without installing such guides was forbidden, in case additional exploratory work might be undertaken at this mine. It was also required that in the event of further work being done here after the removal of the aforesaid rib the ladderway shall be altered so that no ladder shall be more than 34 ft. long, with suitable landings at the foot of each ladder.

McARTHUR NO. 1 MINE.

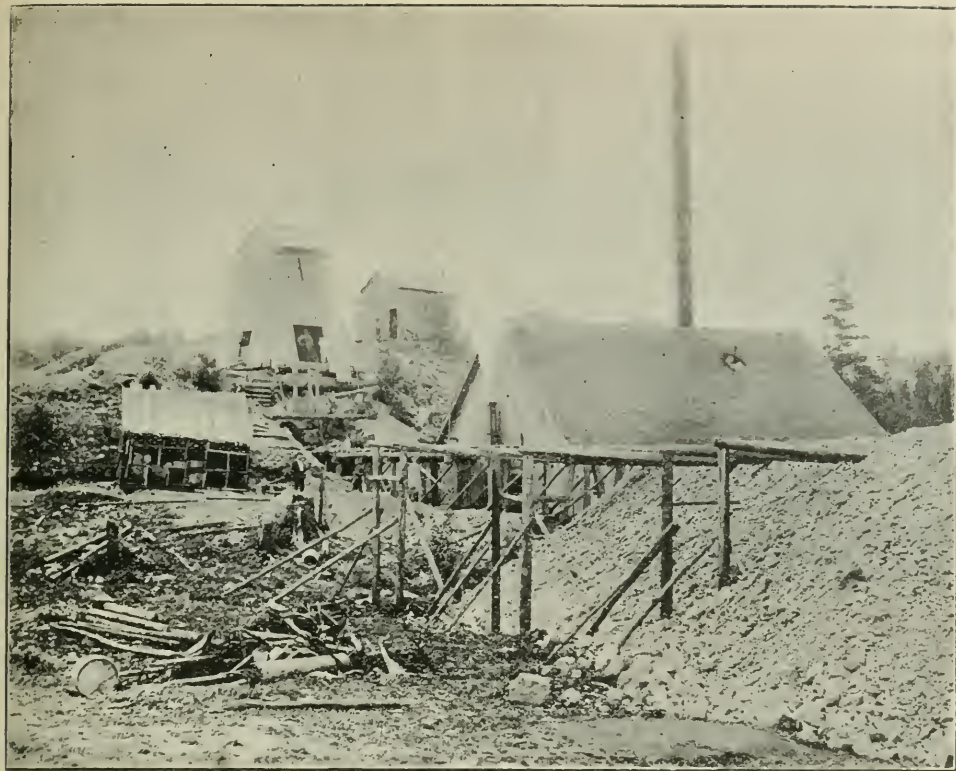
The original McArthur No. 1 shaft has been abandoned, but the new workings adjacent, known as Southeast extension, have been advanced. An open pit, with its major axis parallel with the strike of the lode, has been sunk 127 ft. deep, 75 ft. long, and varying from 8 to 30 ft. wide. The west or hanging wall needs frequent and careful "scaling." An open cut of irregular shape and 20 ft. deep has been driven about 100 ft. south of the open pit. Hoisting from the first pit is done by derrick and kibble, dumping into small pockets by the side of the tramway track. A small dynamite magazine is located 100 ft. west of the tramway, just s.e. of the old McArthur No. 1 shaft.



28. The Olive Gold Mine, p. 72.



20. Mill, Main Shaft, etc., of Olive Gold Mine, looking West, p. 72.



30. Shaft and Power House of Rock Lake Copper Mine, p. 95.



31. Road to Rock Lake Copper Mine, p. 95.



32. Quarry Island Gold Mine, near Sultana Mine.



33. Quarry Island Gold Mine, showing width of vein.

It was required that this be removed to a distance of 300 ft. from the track, unless the maximum quantity ever stored there at one time should not exceed 50 lb. of dynamite. The dry-house n.w. of the old McArthur No. 1 shaft has been completed and put in use.

MCARTHUR NO. 2 MINE.

A two-compartment incline skipway has been carried down to what is called 2nd level, 100 ft. from the surface. This incline is to be abandoned and a shaft will be sunk behind it in the footwall. The angle of the present incline is 60°. The mine consists almost wholly of an open pit of very irregular shape, with two main openings separated by a rib, part of which constitutes a pillar supporting the roof of the remnant of a stope. The larger open pit measures 200 ft. x 100 ft., and the smaller 39 ft. x 35 ft. The pillar is 29 ft. x 20 ft. There is also a smaller pillar 9 ft. in diameter supporting the roof of the stope. Beside the larger pillar is temporarily installed a duplex direct-acting pump. All requirements as to indicator in engine room, fencing around open pits and location of magazine have been complied with. Owing to the slight incline of the skipway between the mine mouth and the "rock house," causing insufficient tension on the hoisting cable, it was required that safety catches be provided at once to prevent the skip escaping in case of breakage of cable, and it was also required to provide a detaching hook to prevent over-winding.

CLARA BELL MINES.

Mine A is distant about 3 miles n.w. from the Copper Cliff mine. The standard gauge railroad has been extended from McArthur shaft No. 2 to these mines. The mine A consists of an open cut 40 ft. wide with a face 25 ft. high. Some work has also been done in an open cut above the lower one, but is not now being continued. Drilling is done by steam drills, deriving power from a small upright boiler temporarily set up near by. A power plant and hoisting works are being erected east of the mine, consisting of an engine room 28 ft. x 36 ft., a boiler room 22 ft. x 50 ft., containing two 100 h.p. boilers, and an air compressor room in which the compressor has not yet been installed. A rock house of the type commonly in use at the mines of this company was to be erected.

Mine B consisted of an open cut 40 ft. wide with a 20 ft. face, 1,200 ft. n.w. of mine A. The railroad extends to this point. A boarding house has been provided a little further toward the w.n.w. on the shore of Clara Bell lake.

THE MACDONALD MINE.

This mine is situated by the side of the railroad, 800 ft. s.e. of Clara Bell A mine. It consists of an open cut 50 ft. wide, with a face 16 ft. high. A power plant is being erected, consisting of an engine room 26 ft. x 30 ft., and a boiler room 22 ft. x 40 ft. The engine room contains a hoisting engine, duplex, 8 in. x 12 in. cylinders, and a 36 in. drum; one 35 h.p. engine for rock house, and an air compressor, duplex, with 16 in. stroke, steam cylinders 10 and 16 in., and air cylinders 14 and 19 in., respectively. The boiler room contains one tubular boiler 60 in. x 14 ft., 70 h.p., and one of 54 in. x 12 ft., 50 h.p. The rock house will be 26 ft. x 41 ft. on the foundations and 35 ft. 8 in. high, to contain one 10 in. x 15 in. Blake crusher, and a screening and picking table plant. The magazine is located 500 ft. n.w. from the mine, with a rise of ground between it and the workings.

STOBIE MINE.

The changes in this mine since last inspection are those resulting from extension of the so-called stopes, which are really chambers, resulting from the extraction of wide ore masses. These are as follows: 2nd level stope, length 124 ft. (an increase of 40 ft.), width 45 ft., height 75 ft. (an increase of 15 ft.). 3rd level stope, length 108 ft. (an increase of 30 ft.), width 80 ft., height 70 ft. 4th level stope, length 100 ft. (an increase of 49 ft.), width 43 ft., height 75 ft. (an increase of 15 ft.). So far as could be seen the walls were not unsafe, but inspection of their condition in stoping chambers of such size was not easy. The requirements made for safety to miners have been attended to properly, and the mine is kept in good condition, well ventilated and drained. The main

explosives magazine is well located 600 ft. from the workings and buildings, but the small magazine was so placed as to endanger the rock house and the upper stope of the mine in case of explosion. It was ordered to be removed 300 ft. beyond a small rise of ground. The system of ore winning in use here not being in steps or benches, but by irregular cutting back of a face of irregular shape and considerable height, leaves no convenient means for access to the upper part of the workings, so that men handling drills and carrying tools to and fro are in more or less danger of accident. It was accordingly ordered that in such situations ropes should be provided to assist workmen in ascending and descending.

SIX AND SIX NINE.

Stripping of deposits, preparatory to mining, has been commenced w.n.w. from the Stobie mine, at a distance therefrom of nearly 2 miles. Two pits have been begun and at the most westerly point a small trestle has been built 40 ft. long to a dump. A railroad is projected from the Stobie mine to these new workings.

SMELTER PLANTS OF THE COPPER COMPANY.

The additions to the old smelter plant consist of two double coke sheds on the east side of the works. Each shed is 196 ft. long by 40 ft. wide, built in pairs back to back, with a trestle for a standard gauge railroad between each pair. The structures are wholly of wood. A 40 ft. x 30 ft. boiler room for two boilers is being erected west of the assay office. A melting furnace for an iron foundry has been temporarily installed in the melting room of the bessemerizing plant. A new smelter is being erected about 300 feet s.e. from McArthur No. 2 rock house, on the brow of the hill, with ample dumping grounds for slag in the valley or draw in front. The dimensions of the new smelter building are 65 ft. by 127 ft. with room for 4 blast furnaces. The coke sheds are built into this building on the north side. The blower house is to be a detached structure, east of the furnace house, 30 ft. x 50 ft. with room for two No. 7 Connorsville blowers, each blower driven by a 40 h.p. horizontal engine. The boiler house for the new smelter will be 30 ft. x 49 ft., for two 90 h.p. boilers.

A new water supply has been provided for the smelters by increasing the height of water in Clara Bell lake by means of a 6 ft. dam. The original area of the lake has thus been increased from 50 to 78 acres, and provision has been made for draining the level down 6 ft. through a canal 800 ft. long. This will discharge the impounded waters into Macdonald lake, the present source of supply.

New roast yards have been started with 8 roast-heaps along the n.w. side of the railroad track from the Copper Cliff to the McArthur No. 1 mine, at a distance of about 800 ft. from the Copper Cliff rock house. The same precautions are taken here against accident as at the old roast yards.

THE GREAT LAKES COPPER CO

This company has been organized with its head office at 60 State St., Boston, Mass., and the following persons as officers: John McKinley, President and gen. mgr., Horace Williston, sec'y., and C. M. Boss, supt. The properties are located on lots 5 and 6, concession 2 of Blezard, district of Nipissing, and lots 9 and 10, concessions 3 and 4 of Trill, district of Algoma. The company also owns 2,300 acres in the township of Davis, district of Nipissing. The mines lie near the middle of lot 5, con. 2 of Blezard, $\frac{1}{4}$ mile s.w. of the company's smelting plant. The workings consist of an open cut 10 ft. deep and 60 ft. long, of irregular width, averaging about 10 ft. Fifteen feet s.s.w. of this is a shaft 53 ft. deep, 7 ft. x 8 ft. cross section, cribbed 12 ft. to solid rock. Thirty feet from the top the shaft changes from the vertical to an inclined position. At the bottom is a drift north 10 ft. Hoisting has been done by windlass. Trenching and some open cut work has been done for a distance of a few hundred feet toward the s.s.w., and at intervals between the shaft and the smelter trenching and stripping have revealed other outcrops of ore. A diamond drill hole has been bored near the shaft to a depth of 125 ft.

The smelting works were built from original designs by Anton Graf of Vienna. The furnace house is 40 ft. x 36 ft., and contains two batteries of five furnaces each, the capacity of each furnace being 1,500 lb. of ore. The operation was to be discontinuous, each charge being separately smelted. The furnaces were to be fired by gas, using a small quantity of charcoal in the charge. It was expected to be able to produce high grade matte at one operation from un-roasted ores. The gas was derived from a small plant in a 12 ft. x 12 ft. building situated a few feet to one side of the furnace house, the gas being produced from some of the more volatile distillates from crude petroleum. This part of the process, however, was secret. The gasometer in the gas house had a capacity of 120 cu. ft. The power plant was in a room adjacent to the furnace room, and contained one 50 h.p. upright boiler, one 25 h.p. and one 30 h.p. engine, one Knowles steam pump, 8 in. x 9 in. x 6 in., one Davidson's air pump, 6 in. x 8 in. x 12 in., and two Sturtevant exhausters and blowers, 14 in. in diameter. From these last were tunnels leading to the furnaces. Thirty feet east of the engine room was a tank house, 26 ft. x 28 ft. Other buildings are a rock house 300 ft. s.w. from the smelter, to contain a Gates rock-breaker plant, and a boarding house midway between the mine and smelter. Dynamite was kept in a locked box 500 ft. from the boarding house.

THE GERTRUDE MINE.

This mine was being developed by the Lake Superior Power Co. of Sault Ste. Marie, Ont., as a source of nickel ore for a new process to be inaugurated at Sault Ste. Marie. The superintendent of the mine was Thomas Travers of Sudbury. The mines are located five miles from Naughton on the "Soo" branch of the C. P. R., on the south half of lots 3, 4 and 5, concession 1 of Creighton, district of Algoma. The Gertrude shaft is on lot 3. It is vertical, 8 ft. x 12 ft. in cross section, and 52 ft. deep, cribbed to a depth of 31 ft. At the bottom is a drift 34 ft. south. Hoisting is done by kibble with $\frac{3}{4}$ in. cable, running over a sheave on a square head frame. The power plant was located to one side of the shaft, and consisted of a temporary frame structure containing a 12 h.p. upright boiler, and a duplex hoist, with drums 14 in. in diameter. Six test pits of small dimensions have been sunk on outcroppings of ore, on lots 4 and 5 to westward of the Gertrude shaft. A diamond drill plant was working at the time of my visit (Sept. 8, 1899) 30 ft. north of the shaft. Dynamite was stored 200 ft. s.e. from the shaft and 120 ft. from the blacksmith shop in a log house, which was not locked. This was ordered to be removed to a place of safety, in accordance with the mining regulations, and to be kept securely locked. It was permitted to keep one day's supply in the existing magazine. The boarding house was 500 ft. west of the Gertrude shaft. A blacksmith shop and a stable were located about 200 ft. n.w. from the shaft.

The properties owned by Dr. Ludwig Mond, farther to the west of the Gertrude mine, were not undergoing development at the time of my visit to this district. The only exploration in progress at that time was by diamond drill borings.

CREIGHTON MINE.

This property, also known as the Stobie Falls mine, is situated on lot 10, concession 6 of Creighton, district of Algoma, opposite the Stobie Falls on the Vermilion river. It is owned by Robert G. Leckie and R. M. Thompson. The outcrop of the vein is at the water's edge, the vein dipping away from the river. A vertical shaft has been sunk 40 ft. from the river to a depth of 115 ft., with a cross section of 6 ft. x 8 ft. It is a single compartment shaft, with a manway. Cribbing has been carried down 30 ft. to solid rock. At the bottom is a crosscut 20 ft. s.s.w., which has not yet intersected the cre-body. Hoisting is done by kibble with a $\frac{3}{4}$ in. cable. The shaft house is 18 ft. x 36 ft., with a boiler room adjacent. A duplex derrick hoisting engine is used, having $5\frac{1}{2}$ in. x 8 in. cylinders. In the same room is a 3-drill Ingersoll air compressor. The boiler room contains two boilers of the locomotive type, made by the Waterous Engine Works, Brantford, each rated at 50 h.p. Pumping from the mine was done by a 12 in. x 8 in. x 4 in. Northey duplex pump. Dynamite was stored 40 ft. from the shaft house. It was ordered to be removed to a distance of 600 ft.

About three-eighths of a mile east of this mine was a small prospect tunnel in copper ore, 35 ft. long. In this deposit the copper pyrites occurred in a calcite gangue, quite at variance with its usual association in this region. This prospect was owned by Frederick Hamilton and others of Sudbury.

THE PARRY SOUND COPPER MINING CO., LTD.

The offices of this company are in Parry Sound, and in St. Paul, Minn. The board of directors consists of Frank Johnson, Robert Forbes, Otto Moreson, Wm. Faulke, and S. F. Pierce, all of St. Paul. The company has acquired the M'Gown mine in Foley township, and the Wilcox mine 14 miles s. s. w. from Parry Sound. The workings at the M'Gown mine consist of a pit, a vertical shaft and an inclined shaft. The pit is on the shore of M'Gown lake, and is 40 ft. x 25 ft., and 20 ft. deep. A considerable quantity of bornite sufficiently rich for smelting has been selected and corded up beside the workings. The vertical shaft is located 400 ft. n. n. w. from the pit. This was in process of sinking and had reached a depth of 54 ft., with a cross section of 10 ft. x 11 ft. Timbers had been set to a depth of 26 ft., using 8 in. x 8 in. timbers, dividing the shaft into 4 compartments, two for hoisting being 4 ft. 6 in. square inside, and two for manway and pump column respectively, being 3 ft. 6 in. x 4 ft. 6 in. Hoisting was done by kibble with $\frac{1}{2}$ in. cable, running over a 20 in. sheave, mounted on a gallows frame 20 ft. high. The hoisting engine was a small duplex machine with 12 in. drum set in an open shed 30 ft. from the shaft. Steam was taken from a 20 h.p. locomotive boiler in the same shed. The inclined shaft was 400 ft. w. of the main shaft, having an inclination of 25° from the horizontal, leaning w. 10° n. Its depth is 100 ft. Hoisting is done by car on a single track, operated by a windlass. The dynamite magazine is 1000 ft. n. of the main shaft. The day's supply is kept in a store house at the mouth of the inclined shaft. A blacksmith shop is located 75 ft. south of the main shaft. The company has purchased and was erecting a gold mill 60 ft. from the west shore of M'Gown lake. The plant is a regulation 10-stamp mill, with Frue vanners, supplied by Fraser and Chalmers of Chicago. The building is 63 ft. square, with a wing for the vanners. The power is supplied by a 60 h.p. return tubular boiler, and a 60 h.p. engine.

Southwest of the mill was a well equipped assay office, and a boarding house. Forty men were working at the time of my visit, (Sept. 11, 1899).

The Wilcox mine had not passed beyond the stage of a mere prospect, insufficient underground work having been done to admit of measuring up any ore bodies. A shaft had been sunk 33 ft., with a 9 ft. x 11 ft. cross section, hoisting by derrick and horse. The ores occur in a shear zone, in garnetiferous schist, with disseminated chalcopyrite and other sulphides said to carry some nickel. On the shore of the sound was a boarding camp, and at a distance of 500 ft. was a dynamite magazine.

The properties acquired by this company embrace the following: The M'Gown group, lots 24, 25, 26, and 27, concession 1, lots 22, and 23, concession 2, lot 16, concession A, in McDougall township, lots 146 and 147, concession A, and lots 142, 143, 144, 146, and A, concession B, of Foley, district of Parry Sound. The Wilcox groups consist of south half of lots 18, 19, 20, 21, and 22, concession 4, and lots 15, 16, and 17, concession 5, of Cowper. The Messagamashine group, lot 23, concession 8, and lot 23, concession 9, of Hardy. The M'Gown mine is on lot 146, concession B of Foley, the inclined shaft on lot A concession B of Foley, and the Wilcox mine on lot 22, concession 4 of Cowper.

THE HATTIE BELL MINE.

A local company in Parry Sound has been organized under the title of the Hattie Bell Copper, Gold, and Nickel Mining Co., with James B. Mitchell as manager. The mine, sometimes called the Lafex mine, is located on lot 35, concession A of Foley, district of Parry Sound. A vertical shaft has been sunk 65 ft., with a cross section of 6 ft. x 8 ft. At the bottom is a drift 10 ft. west. Hoisting is done with derrick and horse, using a wooden kibble. There was no manway, men being lowered and raised in the bucket. Dynamite was also kept carelessly, exposed to the weather, near the shaft. The installation of a ladderway in the shaft, and the provision of a magazine or waterproof locker for dynamite were ordered.

Additional prospecting for copper is going on throughout this region, where the outlook is not unfavorable for the development of workable mines. The most important of the new discoveries, which came under my notice was the McQuade property near Sans Souci, where bornite occurs massive and impregnated through an amphibole schist.

IRON FURNACES.

There are at present two iron furnaces in blast in Ontario, one making coke iron and one making charcoal iron. A third furnace for charcoal iron will soon be in blast at Midland, and a fourth is projected at Kingston, which will use coke. In spite of the encouragement which has been offered to utilize Ontario iron ores, practically all the pig iron produced is from ores imported from the lake Superior region. The difficulty would appear to be a lack of either courage, or of information as to proper mining methods, resulting in an effort to produce ore before the mines have been properly developed. In consequence the output is uncertain, and the ores coming almost wholly from near the surface are of uncertain iron content. Many of the Ontario ores, especially in the eastern district, where alone they have been exploited to any extent, contain a considerable amount of iron pyrites, requiring careful sorting before shipment. At the Coe Hill mines, and also at other mines farther east, large quantities of ore have been thrown on the dump which it is claimed could be concentrated by the improved systems of magnetic separation and brought up to smelting grade. There would seem to be warrant for believing that if the high grade ores were sorted out, and the sulphurous ores crushed and concentrated, there are mines in the Province which could be operated on a fairly large scale. But even with this in view, extensive development work needs to be done at practically every iron location in Ontario. A large output is promised from the discoveries in Michipicoton mining division, but these have not yet been rendered available. The magnetite deposits along the line of the Kingston and Pembroke Railway have received considerable attention, and fitful shipments are made from that district; but here again the development has not been done which will enable any furnace to depend upon them for its ore supply. Moreover, when used unmixed with hematites these ores, on account of their great density, do not reduce with sufficient rapidity in the furnace, causing serious difficulty. An attempt is being made to weaken the structure of these ores by roasting, so as to enable them to be used in larger quantities. This experiment, which is being tried at Hamilton, will be of great interest.

HAMILTON FURNACE.

The present campaign of the Hamilton blast furnace commenced on June 19, 1897, and will continue until the spring of 1900, which is indication of good technical control. It is worthy of mention that the technical adviser at this plant was trained in Ontario (at the Kingston School of Mining). The furnace is 75 ft. high, 16 ft. in diameter at the boshes, 10 ft. at the crucible, and the same diameter at the throat. The blast is heated in a plant of 3 modified Whitwell stoves, 60 ft. high and 19 ft. in diameter. The temperature of the blast is 1300° F. The power house contains 12 boilers, 8 in constant use, each of 250 h.p., heated by waste gases. The two blowing engines are rated at 1200 h.p. each, the blowing cylinders 5 ft. by 7 ft. The stock sheds have a capacity of 50,000 tons of ore and stone, and the coke sheds have a storage capacity of 2000 tons. The cast house measures 48 x 150 feet, casting being done every four hours, 25 tons of metal at a cast. A new furnace is to be built promptly, and ground has been broken for a steel plant, which will contain a basic and an acid open hearth converter, of the William tilting type, of 15 tons capacity each. The ore used at Hamilton comes almost exclusively from the Mesabi range, the stock on hand showing the following composition:—

Moisture	12 to 14 per cent.
Iron	62 per cent.
Silica	3 " "
Alumina	1.5 to 2 per cent.
Lime (CaO)	0.25 "
Magnesia (MgO)	0.25 "
Phosphorus	0.07 "
Sulphur	0.005 "

Connellsville coke is used, coming by all rail. Considerable difficulty has been experienced in obtaining a high grade coke, with a uniform percentage of ash. This may be due to the present excessive demand for coke, causing the coke-makers to pay less regard to the quality supplied than would be the case in dull times when competition was keener.

DESERONTO FURNACE.

The Rathbun Co. of Deseronto put their new charcoal furnace into blast on January 25, 1899, since which time it has been in successful operation, making a high grade of iron, some of which has found a market in England. The furnace is 61 ft. high, 9 ft. 6 in. at the boshes, 7 ft. at the tuyeres, with a crucible 5 ft. 11 in. deep. A 75 h.p. vertical blowing engine is used, the blast being heated in a U-tube stove. The ores employed come from the lake Superior district, only small quantities of Canadian ores having been experimented with. The company's charcoal plant is of great interest. Both kiln burning and retorting are practised. There are 17 beehive kilns of red brick, 28 ft. in diameter and 20 ft. high. A tunnel in the bottom leads the vapors to the mains, which convey them to the copper tube condensers in the by-product plant. Each kiln holds 40 cords of wood, and burns three days. It is then allowed ten days to cool. Imperfectly charred wood constitutes 10 to 12 per cent. of the product, and 5 per cent. of breeze is made. The retort plant contains 50 steel retorts, 50 in. in diameter and 9 ft. long, set in fire brick, cased outside with common brick. The charge for each retort consists of $\frac{3}{4}$ cord of wood, which is retorted in 24 hours. Each pair of retorts has a separate heating chamber. There is no imperfectly charred wood, but the percentage of breeze is about the same as in the kiln-charring. This is mixed with tar condensed from the vapors, and is used for heating the retorts in conjunction with the gases, which, after passing through condensers at the back of the retort block are trapped and led back into the heating chambers. The charcoal is drawn into steel cars and smothered down with steel covers. For the operation of this plant a total force of 18 men is employed. The by-product plant is of the ordinary sort, producing 400 gallons of wood alcohol and $2\frac{1}{2}$ tons of acetate of lime *per diem* of 24 hours.

THE MIDLAND FURNACE.

The Canadian Iron Furnace Company, Limited, of Montreal, has acquired property on the north side of Midland harbor, consisting of an 80 acre strip having a half mile water frontage. The municipality of Midland has granted the company a bonus of \$50,000, and exemption from all but nominal taxation on \$25,000 for 10 years. Work was actively in progress, preparing for construction, in September. The plans provide for a 75 ft. furnace, $13\frac{1}{2}$ ft. at the boshes, $7\frac{1}{2}$ ft. in diameter at the crucible; 3 Whitwell stoves, 60 ft. high; 2 vertical blowing engines 5 ft. stroke, steam cylinder 36 in. in diameter, and air cylinder 84 in. in diameter. A wharf 400 ft. long is to be built, with 18 ft. of water alongside, and stock sheds as a continuation of this wharf. A by-product charcoal plant is to be erected with 60 circular kilns 30 ft. in diameter each. The woods available are mostly beach, maple and "iron-wood." It is estimated that the cost of hardwoods on the dock at Midland will be \$1.25 per cord, and of soft woods \$1.00 per cord. The company is hoping to secure its iron ore supply from Michipicoton, but it is in any case very favorably located for a cheap supply of the best ores in the world for a high grade pig iron. Among other advantages which the company points out is that Midland is as favorably located so far as the Lower St. Lawrence trade is concerned as Hamilton, for all transportation by rail, the length of haul from Midland to Montreal being practically the same as from Hamilton.

IRON MINES.

The development of the iron mining industry can not be said to have been satisfactory. The causes have been indicated in my remarks on the iron smelting industry. The thorough development of one good mine would give an impetus to all the others. It

must be said that the owners of iron mines in eastern Ontario have been unfortunate in the selection of managers, many of whom have proven unequal to the problems presented for their solution. But for this, the mine owners themselves are to blame. The failures made have led the mine owners to resort to the system of leasing to operators under a sort of tribute system, attended with its usual evils. In a region where mining has not developed to large proportions the tribute system is certain to lead to a mere gouging out of ore, with no regard to systematic work, which would leave the mine in condition for future economical production. The net result of the methods pursued has been to discredit the iron mines of the eastern district, which is most unfortunate. The geological occurrence of some of these deposits at least is such as to warrant the belief that well-directed operations would put ore-bodies in sight which could be profitably mined.

THE BEDFORD MINE.

This mine, which is situated near the Zanesville P. O., has been intermittently worked, shipping small quantities of ore during the year. The old pit has been deepened to 35 ft., and a new inclined shaft has been sunk 64 ft., with a cross section of 15 ft. x 20 ft. One pump was working, and a new and larger one was being set up. A derrick hoisting-engine, with 8 in. x 10 in. cylinders was being used, taking steam from a 20 h. p. upright boiler. New plant had been ordered, which was expected to be installed during the autumn. There was a good surface showing of magnetite, mixed with some hornblende and calcite, and a new discovery had been made near by of phosphatic iron ore, for which a market could be obtained if a sufficiently large deposit could be placed in sight to insure a steady supply. Systematic development at the Bedford mine is certainly warranted by surface indications.

COE HILL MINES.

Experiments are being conducted at the Edison concentrating works at Ogden, N.J., and also at Dunbar, Pa., with ores from these mines, under the supervision of Mr. G. A. Longnecker of Mechanicsburg, Pa., and of Mr. John Morris of Dillsburg, Pa., in the hope of being able to utilize the Coe Hill ores. At the time of my visit (Nov. 4, '99), it was reported that the outlook for solving this problem was very favorable.

CALABOGIE MINES.

New development has been going on two miles by road east of Calabogie station on the Kingston and Pembroke Ry. The mines are situated on the east half of lot 16, concession 9 of Bagot, Renfrew county. This work has been in progress since April, 1899, under lease by the Hamilton Steel and Iron Co. from the owners, Boyd Caldwell & Co. of Lanark. The main working called the T. B. pit was 30 ft. deep, 30 ft. in diameter at the top, and 15 ft. in diameter at the bottom. Hoisting was done by a derrick with a 40-ft. mast and 45-ft. boom, using an iron bucket of 1,200 lb. capacity for ore, and a wooden "flat" of 2,400 lb. capacity for waste rock. The engine house was 75 ft. east of the pit, containing a 12 h. p. boiler and engine with a single drum, winding a $\frac{1}{2}$ in. steel cable. Drilling was done with one Mack and one Ingersoll Sergeant drill, using steam, and the pit was kept unwatered by a 4 in. x 6 in. x 8 in. Cameron pump. Two other openings had been made, but were not then working (Dec. 8, 1899), known respectively as the Jeannette open cut, 200 yards west of the T. B. pit, and the Tommy R. pit, 700 yards west of the T. B. pit. Dynamite was stored in a log house half a mile west of the workings. Fulminates were kept in a store house near the camp. Thawing was done with a horizontal tubular thawer, in a small building near the mine, where the day's supply of explosives was kept. Other buildings were a boarding house, lodging houses, a blacksmith shop, carpenter shop and stable, located approximately 225 yards west of the T. B. pit. Instructions were given as to providing a manway and signal system at the T. B. pit.

THE CALABOGIE MINING CO.

This corporation, with offices at Perth, had sunk a pit 60 ft. deep, 200 ft. east of the T. B. pit, which was abandoned, and full of water at the time of my visit.

THE ROBERTSVILLE MINES.

These mines had been working at infrequent intervals. In the Lizzie mine drilling with two drillers had just been commenced on Dec. 9, 1899. In the interval since my last visit another hole had been broken through from the upper to the lower stope, 20 ft. west of the skipway. During the summer the lower stope had been pumped out by the Hamilton Steel and Iron Co., but had been allowed to refill with water. The Ferguson pit had been deepened to 35 ft., on a 35° angle. The pit had been widened out to 25 ft. in the winning of ore. The surface plant remained unchanged. This property was being operated on lease from H. A. Ferguson of Kingston to F. W. Schwendiman and Thomas Barnes. The dynamite magazine had been removed, according to previous instructions, to a point 400 ft. south of the Ferguson mine.

EQUITABLE MINE.

A company has been formed to work certain deposits of iron ore occurring in the vicinity of Dog lake, in Storrington township, Frontenac county. Operations at the time of my visit (Oct. 19, 1899) were confined to an outcrop in Potsdam sandstone on lot 20, concession 10 of Storrington. The workings consisted of an open cut into the hill, with a working face 31 ft. 6 in. high, and having a length of 39 ft. and a width of 32 feet. On the top of the hill 25 ft. south of the open cut was a pit 15 ft. deep. Seventy-five tons of ore had been piled up ready for shipment. Transportation from this point can be accomplished by barges running from Dog lake to the Rideau canal. The dock is situated 300 ft. from the open cut, having 18 ft. of water alongside. No permanent plant or buildings had been installed.

Prospecting was in progress at many other points in this locality, the most advanced of which was on the Ennis farm on lot 14, concession 9 of Storrington, where an open cut had been driven 18 ft. with a width of 20 ft., having a breast 10 ft. high.

WILBUR MINE.

One of the best developed iron properties in Ontario is that known as the Wilbur mine, about two miles from Lavant. It is situated on the line of the Kingston and Pembroke Ry., from which a siding a half mile long has been built. There are four pits in all, located as follows: No. 1, on lot 4, concession 12 of Lavant, Lanark Co.; No. 2, ditto; No. 3, on lot 4, concession 13 of Lavant; No. 4, ditto. The owner is Mr. William Caldwell, of Toronto. The mine is being developed by a force of 18 men, under the superintendence of Samuel Jackson. In the process of development which has been carried on in No. 3 and 4 pits 5000 tons of ore have been extracted, with an estimated iron content of 58 per cent.

The several pits are located along the outcrop of a magnetite deposit, with crystalline limestone on the footwall, and gneissoid and schistose rocks on the hanging side. The latter show some intrusions of felsitic dikes. Between both the foot and hanging walls of the deposit are bands of amphibole schist. The magnetite contains some calcite, but is remarkably free from silica and pyrite.

Pits No. 1 and 2 were worked in times past, but are now abandoned. Preparations however are being made to pump out pit No. 2 and continue development there. The largest amount of work recently done has been confined to pit No. 3. An open pit, 300 ft. long, was originally made, averaging about 20 ft. in depth. At about mid-distance in this an inclined shaft was carried down at an angle of 38° to a depth of 90 ft., with a cross-section of 15 ft. x 12 ft. extending toward the s. s. e. At this depth a drift was run 70 ft. straight ahead, which then turned eastward 105 ft. to a stope of irregular shape, 30 ft. by 40 ft. From this stope an old drift 230 ft. long connects with the abandoned workings of the old pit No. 1. An inclined upraise has been driven from the stope to the bottom of the open pit, which is to serve in future as the main shaft. Thirty feet west of the stope is another drift, southwards from the east and west drift, extending 56 ft. in ore. There is also a "break-through" from the bottom of the present shaft to the old stope, a distance of 90 ft., thus leaving a block of ore 70 ft. by 100 ft. (average) and 25 ft. high. At the bottom of the shaft is a direct acting duplex pump, 4" x 5" x 6",

built by A. R. Williams & Co., Toronto. In the old drift eastward, 100 ft. from the stope, is another duplex pump. A tramway extends from the bottom of the shaft around to the stope. Pit No. 4, 400 ft. w. s. w. from No. 3, was opened in the same manner, with an inclined shaft s. s. e., on an angle of 30°, with a depth of 96 ft. This at present is not working. The main power house is situated 200 ft. e. n. e. from shaft No. 3. It is 40 ft. x 37 ft., with a woodshed 12 ft. x 12 ft. It contains a 60 h.p. return tubular boiler, a 3-drill air compressor, built by the Morris Machine and Iron Co., Dover, N.J., a 6 ft. x 3 ft. receiver, carrying an air pressure of 60 lb., and a double-cylinder, single-drum hoisting engine, built by Barber & Co., Allentown, Pa. This winds a 1 in. cable, running over idlers to the shaft mouth, where it turns at right angles into the shaft.

An oil house 9 ft. x 8 ft. is located 100 ft. e. n. e. of the engine house. A dry house, well provided with all conveniences, is situated 35 ft. s. w. from the engine house, and 95 ft. farther on is a blacksmith shop, 24 ft. x 16 ft. A small hoisting engine in a 12 ft. x 12 ft. frame building is located 40 ft. n. n. w. from the mouth of shaft No. 4. Steam is piped to this from the main power house. The dynamite magazine, storing one ton of dynamite, is located on the side of a hill 500 ft. w. n. w. from the power house. It is built of logs, surrounded by a dry-wall of stone. A thawing house was situated 120 ft. w. n. w. from shaft No. 3, heated by a stove. No thawer was used. The dwelling houses begin at a distance of 700 ft. w. n. w. from the engine house. A Sullivan diamond drill was set up 600 ft. south of pit No. 3. One hole had been bored previously between this point and the pit. The depth of hole at the new location was 45 ft. The outlook for a permanent industry here is encouraging. Recommendations were made as to the proper care of dynamite, and a brake was ordered to be attached to the hoisting engine in the main power house.

NATURAL GAS.

The natural gas producing area of Ontario is at present limited to the counties of Essex and Welland. In Essex county the producing horizon is confined to the Clinton limestone, which is reached at depths of from 950 ft. to 1000 ft. from the surface. The wells in this district vary from 965 ft. to 1033 ft. in depth. The rock dips toward the north at the rate of about 75 ft. to the mile. It is assumed that the rocks from which gas is now obtained constitute the northern slope of an anticlinal fold, whose axis passes somewhere near Pelee island in lake Erie, a well on that island reaching the gas rock at a depth of 700 ft. Accordingly the desirable locations for wells on the mainland are as near to the lake shore as possible. Less than a mile inland the wells become practically unproductive, or at best have but a short productive life, speedily becoming drowned out by an influx of salt water. It is now proposed to make borings on Pelee Point, so as to tap the gas rock as near the anticlinal axis as possible. While it is true that the yield is more satisfactory the farther south the wells are located, there appear to be areas, even in the zone which is worked, which are less productive than others, or which fail to yield gas at all. This seems to be due to the character of the rock, which varies considerably in porosity at different points. There are thus distinct reservoirs of gas, determined by the amount of porosity. The largest flow of gas is naturally obtained from such reservoirs, but on the other hand these suffer exhaustion sooner than those where the gas rock is relatively more dense. The salt water having risen into this porous rock is rather slowly expelled, as gas again accumulates by flowing in from the adjacent territory, so that recovery is tardy, and never permanent. A "drowned" well, after being shut off for a period, may again yield gas for a short time, but usually it will flow gas for only a few hours at most, when it will begin to spout water. The influx of water takes place as soon as the gas pressure becomes reduced to about 100 lb. per square inch, though in some wells a reduction of pressure to 200 lb. admits the water. In the earlier days of the field the "rock pressure," that is, the pressure of the gas, was 400 lb. per square inch. It has now been reduced to 350 lb., and is slowly but constantly lowering. In exhausted or "drowned" wells the salt water rises to within 75 ft. of the surface.

In Welland county the gas-yielding horizons are the Medina sandstone and the Clinton limestone, most of the wells drawing from the Medina formation. The dip of the rocks here is 30 ft. to the mile toward the southeast, but there is no anticline toward which the gas may accumulate. The wells vary from 850 ft. to 1100 ft. in depth. In this district no difficulty is experienced by an influx of water, but the pressure is declining. Ten years ago the "rock pressure" was 430 lb. per square inch, which has now been reduced to 173 lb., and in some parts of the field to 125 lb. "Shooting" the wells seems to produce an increased flow of gas in very few instances, although this practice has been resorted to with some advantage in a few wells owned by the Essex Standard Oil and Gas Co. in Essex county.

The composition of the gas shows some differences in the eastern and western fields, those in Welland county generally containing appreciable quantities of nitrogen, and in one well at least a considerable amount of hydrogen sulphide. An analysis of the gas from the Point Abino well, made by Prof. Francis C. Phillips of Allegheny, Pa., showed the following composition:—

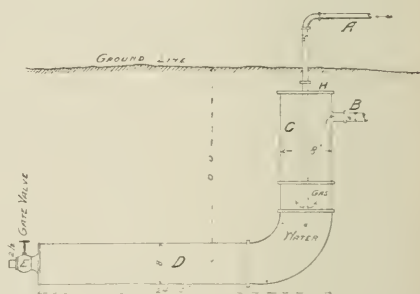
Hydrogen sulphide	0.74 per cent.
Nitrogen	2.69 "
Carbon dioxide	trace.
Hydrocarbons of the paraffine series	96.57 "
	<hr/> 100.00

The percentage composition of these paraffines by weight was:—

Hydrogen	24.10 per cent.
Carbon	75.90 "
	<hr/> 100.00 "

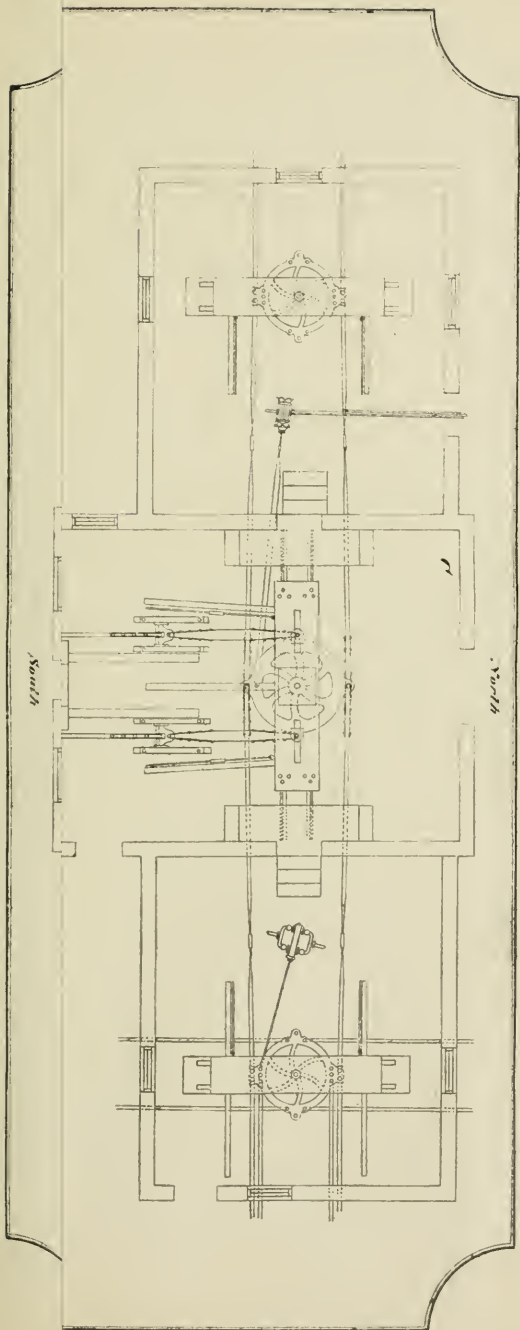
This gas was found at a depth of 550 ft. below the surface.

The amount of moisture requiring elimination from the gas is much less in the Welland than in the Essex field. No drifts are used in Welland county, but at intervals the accumulation of water in sags on the gas line is drawn off. In Essex county a form of drip, differing in some respects from those commonly employed in gas fields, has been designed and put in operation by Mr. Harrison Smith, field superintendent for the Natural Gas and Oil Company of Ontario, Ltd. This is shown in the accompanying diagram. The gas main, A, is led through a drum-head, H, concentrically into an 8-inch vertical pipe, C. The pipe C is carried to a depth of 6 ft. below the post line, and then turns at right angles, being continued 24 ft., terminating in a reducer with a 2½ inch gate valve for drawing off the water which accumulates in the horizontal portion of the drip tube. The gas main, A, terminates 4 ft. from the drum-head, and the gas flows up through the 8-inch pipe and issues through a 4-inch main, B. In expanding as it passes from the 3-inch main into the 8-inch pipe, the gas parts with most of its moisture, which falls into the horizontal portion of the large pipe.

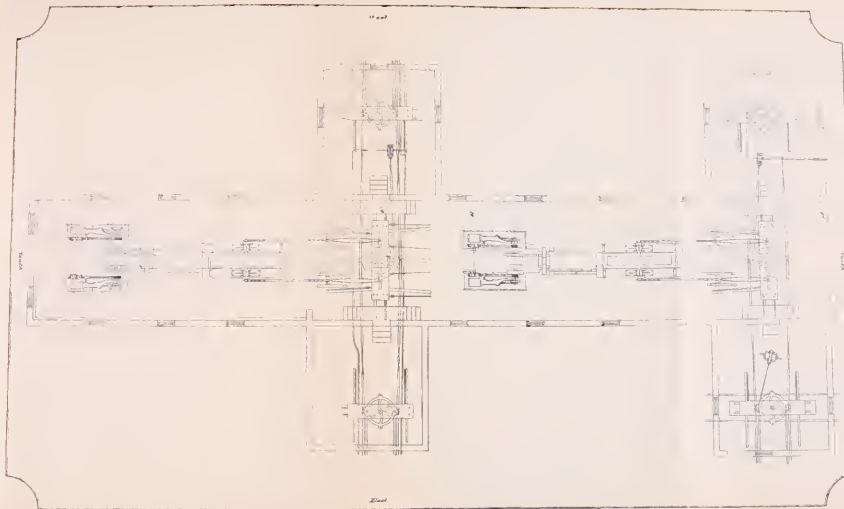


Drilling in the gas fields is done almost exclusively by the American system, with ropes instead of with rigid rods. The rod system is more rapid to shallow depths, but is slower and more expensive when depths exceed 600 ft.

In Welland county considerable gas is employed for burning lime, but most of the gas is exported, both from this and from the Essex field. By an Order in Council the exportation of gas from Essex county is to be restricted after three years from August 1st, 1898, to that required for consumption in the city of Detroit, and during these three years it is limited to three billion cubic feet per annum.



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Plan of J. L. Eaglehart's Pumping Rig at Petrolia, p. 107
Scale, 134 feet = 1 inch

PETROLEUM.

The report of the Bureau of Mines for 1898 gives the situation in regard to petroleum production so fully that practically nothing remains to be said on this point. In the Petrolia district 45,000 to 50,000 barrels per month are being pumped, and the new Sarnia township field along the London Road was pumping 2,000 barrels per month at the time of my visit in September, 1899. Drilling was still actively going on in the old districts, and torpedoing was giving good results in increasing the flow in many old wells. The shallow depth of the wells in this field admits of drilling a great number of holes over a small area, without entailing prohibitive expenses. The average depth of wells is from 465 ft. to 480 ft. The well-drilling contractors undertake to drill a well for 475 ft. to 500 ft. for \$125, furnishing their own fuel, water, labor and conductor pipe. The hole is drilled with a diameter of $6\frac{1}{4}$ in. through the watery strata, and is then continued, after casing has been put in, with a diameter of $4\frac{5}{8}$ in. for the dry hole. The contractor puts in the casing, which is furnished by the owner of the well. He also leaves the derrick and machinery from 24 to 48 hours after the well is drilled, for testing. During this time the well is torpedoed, from 8 to 25 quarts of nitroglycerine being used for this purpose. The derricks are very substantially built, 50 ft. in height, and are transported from place to place on trucks. The engine house is similarly built for removal on trucks. The rigid rod system is employed entirely for drilling by this method. The contractor puts in the pump before leaving, and sets up a three-pole derrick over the well for harding the pumps and piping.

Deep drilling in the Petrolia district was contemplated, in which case wells would be drilled about 3,000 ft. to the Trenton limestone, seeking either oil or gas. As a preliminary to the carrying out of this plan, the question of a franchise for supplying the town with gas was to be submitted to the people. Deep drilling was also to be undertaken at Inwood by a private corporation, consisting of parties connected with the Standard Oil Co., which company has bonded all the land in that vicinity.

The pumping system which has been developed in these oil fields differs in some interesting particulars from that in vogue in Pennsylvania. A good example of the system is that in operation by J. L. Englehart & Co., at Petrolia, where one central power plant pumps from 233 wells scattered over an area of 400 acres (see Plan). It is a balanced system, half of the dead load of rods and mechanism in the field being lifted while the other half is descending, so that the power required is only that for overcoming inertia and friction, plus the weight of the oil lifted at each stroke. Counterweights are thus superseded, reducing the mass of material to be moved, giving in consequence a higher efficiency for the horsepower expended. In the case of the Englehart plant, four engines coupled in pairs, each of 40 indicated horsepower, serve the entire group of 233 wells. These two pairs of engines are connected to two main or "master" wheels, which, in addition to direct connections to pumps, operate 22 secondary or "local" wheels, controlling two jerker rods each. These wheels are large discs set horizontally, cast with four lugs at the ends of two diameters at right angles to each other. Each lug carries two wrist pins for connecting the jerker rods. The wheels have a reciprocating motion imparted to them, swinging through an arc long enough to give the jerker rods the necessary forward and backward motion to produce the proper length of stroke at the pumps, which is communicated to them in the ordinary way by walking-beam or triangle-arm connections. The jerker rods are of wood with spliced joints, suspended from posts by pin-connected hangers of iron, these rods, in conjunction with the pump rods, serving as the counterbalance in the system. The pump rods are of gas pipe, $\frac{3}{8}$ inch pipe being used with a $1\frac{1}{4}$ inch pump, and $\frac{1}{2}$ inch pipe with a $1\frac{1}{2}$ inch pump, their average length being 475 ft. At the Hillier farm, eight miles east from Sarnia, there are two systems of pumps, of 84 and 26 wells respectively, pumping from a depth of 480 ft. The wheels used here, instead of being cast, are made of two discs of $\frac{1}{8}$ in. boiler iron bolted parallel to each other with two inch spaces between. The lugs are then riveted at their proper places on the circumference of the wheels. This field has been opened but one year, and gives excellent promise.

CEMENT.

During the year I visited three of the works in the Province where Portland cement is manufactured. The localities where these industries flourish are in the vicinity of Owen Sound, and to the northward of Napanee in the eastern district. Hydraulic cement is made in the vicinity of St. Catharines, near Hamilton, and at Limehouse, but these works were not visited.

THE OWEN SOUND PORTLAND CEMENT COMPANY, LTD.

The officers of this company are: John Lucas, president, J. E. Murphy, vice president, R. P. Butchart, general manager, George S. Kilbourn, secretary and treasurer, and W. H. Pearson, director. The works are located at Shallow lake, 9 miles from Owen Sound. The raw materials, marl and clay, are here found together, the clay underlying the marl, the deposit constituting the bed of Shallow lake, which overflows the entire area in the spring time, but dwindles to a small size later in the season. The material is dug by a steam excavator and loaded directly upon cars, running on temporary tracks leading to the inclined plane by which they are elevated 40 feet for dumping upon the stock pile. The cars are drawn by animal power to the foot of the incline, where they are hitched to a cable connected with a winding engine, which carries them to the top. There are two winding engines with 3 ft. drums and duplex 7 in. x 9 in. cylinders. The details of the process of cement making in these works are not given to the public, but in general it may be said that the wet system is employed. After grinding and mixing, the pulp is standardized and then pumped to the drying chambers, and thence transferred to the kilns for burning. At present the "slurry," or burnt cement, is passed through crushers and then ground in tube mills with Baltic quartz pebbles. Krupp ball mills are being installed for intermediate comminution between the crushers and tube mills. The power plant consists of 4 boilers of 150 h. p. each, two made by Cowan and Co. of Galt, and two by the John Doty Engine Co. of Toronto; one Reynolds Corliss compound condensing engine, 500 h. p., one Brown engine, 300 h. p., and one high speed 30 h. p. engine for driving a 10 k. w. dynamo.

The company has acquired other property in the vicinity, on which new works will be erected with larger capacity than those now operating.

THE GEORGIAN BAY PORTLAND CEMENT CO., LTD.

This company has lately been organized, and was erecting a large plant on the s. e. side of the bay in the municipality of Owen Sound. The works lie between the tracks of the C. P. R. and the water. A slip is being provided which will have 18 ft. of water by the wharf. The personnel of the company is as follows: President, M. Kennedy, vice-president, H. B. Harrison, sec. and treas., J. W. Maitland, A. G. McKay and S. Lloyd, directors. The capital stock is \$95,000, of which \$85,000 is paid up. The marl is to be obtained from Williams lake, 13 miles distant on the C. P. R., near Holland Center station. Its analysis shows:

Lime carbonate	95 to 97 per cent.
Alumina and iron oxide	0 38 "
Insoluble residue	3 15 "
	<hr/> 98.53

The clay is found on the opposite side of the bay, where $7\frac{1}{2}$ acres have been acquired with a bank averaging 23 ft. in depth. The analysis of the clay is:

Loss of ignition	12.16 per cent.
Silica	51.52 "
Alumina and iron oxide	23 18 "
Lime (CaO)	10.92 "
	<hr/> 97.78

The principal buildings already erected are the main building 200 ft. x 60 ft., the dry house 140 ft. x 100 ft., and the storage house 300 ft. x 60 ft. The process will be as follows:

The raw materials, in the proportion of 1 of clay to 4 of marl, will be mixed for 15 minutes in a battery of 3 mixers or wet pans of the Ohilean-mill type, except that the pan revolves beneath the rollers. The rollers are 48 in. long and 14 ins. in diameter, the pan having a diameter of 9 ft. and a depth of 16 in. In the bottom of the pans are renewable liners. The pulp is discharged to a conveyor which carries it to a horizontal pug mill, where it is stiffened by the addition of ground cement-brick. This prepares it for pressing in an ordinary brick machine. The bricks are stacked on iron "pallets" and set in a skeleton steel car which is run into the drying oven. The Cummer direct-heat hot air system is employed, this part of the plant being installed by the F. D. Cummer and Son Co. of Cleveland, Ohio. After drying, the cars are taken to an elevator which lifts them to the charging floor of the kilns. The burning plant consists of 4 Aalborg kilns, each 100 ft. high, 20 ft. in diameter at the bottom, $4\frac{1}{2}$ ft. at the throat and 15 feet at the top of the hopper. From the kilns the burnt bricks are carried by a conveyor to two Jenisch and Loehnert's ball mills, supplied by F. L. Smidth and Co. of Willoughby, Ohio. The material is here reduced to No. 24 brass-wire mesh. The pulverizing is done in a Davidsen's tube mill, 24 ft. long by 5 feet in diameter, using Baltic quartz pebbles. In this mill the cement is ground to pass a No. 100 mesh screen. The power plant consists of 3 return tubular boilers, 14 ft. x 5 ft. 6 ins., 100 h. p. each, and a 350 h. p. compound condensing engine made by the Goldie & McCulloch Co. of Galt. Tests made on cement produced from the materials to be used in this plant show the following strength :

Briquettes, 2 days old	190 lb. per sq. in.
" 4 "	440 "
" 5 "	525 "
" 6 "	640 "
" 18 "	675 "
" 30 "	750 "

NAPANEE MILLS CEMENT WORKS.

The Rathbun Co. of Deseronto is operating a large cement works at Napanee Mills, under the superintendence of F. G. B. Allen. The raw materials, both marl and clay, come from Marlbank, a station 15 miles farther north on the Bay of Quinte Railroad. The system of manufacture pursued here is substantially the same as that which will be put in operation by the Georgian Bay Portland Cement works at Owen Sound. The mixing of the pulp is accomplished in two drag-mixers 25 ft. in diameter, with 4 plows each, attached by chains to revolving arms. From this the pulp passes through a tube mill with $\frac{1}{2}$ inch steel balls. It is then standardized, and part passes to a revolving dryer and part to a pug mill, where the dried "slurry" is reunited with it to stiffen it for pressing in the brick machine. The bricks are then dried in a Cummer dryer, burnt in kilns and ground to No. 20 mesh in a Smidth Ball Mill, and subsequently to No. 100 mesh in a tube mill with Baltic quartz pebbles. The revolving dryer mentioned above is a cylinder fitted with angle plates projecting on the inside to carry the pulp up and cause it to fall through the current of hot air passing through the cylinder. Two types of kilns are used, the burning plant consisting of 2 Aalborg kilns and 2 batteries of Dietsch kilns, built in pairs, back to back. In the latter the bricks fed in at an upper vertical stack pass down to an inclined bench or offset in the furnace, and thence into a lower vertical shaft where the burning is finished at a high temperature. These works produce two brands of cement known as "Star" and "Ensign" respectively. The capacity of the plant is something over 100,000 barrels per annum.

STONE QUARRIES.

A number of quarries were visited during the year, some of which were of peculiar interest from the methods employed in working out the stone. No effort has been made to visit all the quarries in operation, owing in part to their large number, and in part to the circumstance that many of them are not working continuously, so that trips

to them are made fruitlessly. There is very little danger of serious accidents at the great majority of quarries, the operations being of so simple a character, and the quantities of explosives kept on hand being usually so small.

THE OWEN SOUND STONE CO., LTD.

This corporation has the following officers: Pres't., H. B. Smith, sec. and treas., S. J. Parker, and manager, P. W. Sabiston. The chief quarry is known as the Mono, situated in Mono township, Dufferin Co., 4 miles northeast of Orangeville on a spur of the O.P.R. The product is a very compact, light gray sandstone, and is extensively quarried for bridge and building stone. There are five benches, varying from 4 ft. to 7 ft. in thickness. Only one bench is now being worked, this having a thickness of 6 ft. The workable stone is overlaid by 15 ft. of thin-bedded limestone and 15 ft. of soil. The sandstone itself presents some remarkable examples of cross-bedding, which interferes somewhat with the systematic development of the benches. In spite of these difficulties the quarry is well laid out and operated. Three derricks, with 60 ft. masts are used, operated by horsepower. At one time an inclined plane was used for hoisting the stone to a sawing and planing plant, but this has now been abandoned and the dressing works are dismantled. The only other buildings are a blacksmith shop and an office, in one part of the latter being kept a small supply of powder.

NOTTAWA QUARRY.

The same character of stone as that found in the Mono quarry is being worked out in a small quarry $\frac{1}{4}$ mile to the southeast, by the owner, Isaac Nicholson. There is less super-jacent limestone and soil at this quarry, and the stone is of a high quality. It is expected to open this out shortly on a larger scale. There were two derricks set, having masts 45 and 55 ft., and booms 40 and 45 ft. respectively. The buildings consist of a blacksmith shop and an office, in which is kept the supply of explosives, consisting of one keg of powder. The quarry is on lot 6, concession 1 of Mono.

SMEETON'S QUARRY.

In the vicinity of Inglewood are a number of quarries, of which Smeeton's is the only one now working. This is situated $1\frac{1}{2}$ mile s. w. of Inglewood. The benches operated consist of brownstone, 2 ft. thick, underlaid by gray sandstone from 2 to 3 ft. thick, each opened about 500 ft. in length. Three horsepower derricks were being used, and drainage was effected by a duplex steam pump. The magazine was located 800 ft. from the workings. Two car loads of curbing *per diem* were being shipped at the time of my visit, Sept. 19, 1899.

A visit was also made to Thomas Murray's quarry, $1\frac{1}{2}$ mile northwest of Inglewood, but it was found to be abandoned. A tramway extends from Inglewood to this quarry.

D. ROBERTSON AND CO'S. QUARRY.

One and a half miles east of the Forks of the Credit in Caledon township is the quarry of D. Robertson & Co of Toronto. There are 4 benches working, yielding both gray and brown stone, the brown strata lying above the gray. Three derricks were set up, and a force of from 20 to 30 men were employed. The shipments amount to about 12 carloads of curbing a week. The stone is sent in trams down a 3 rail incline, 500 ft. long, to the siding on the railroad track (O.P.R.) at the bottom of the hill below the quarry. The cable makes 3 laps around a drum 5 ft. in diameter, the cable ends being attached to cars. The drum is provided with band friction brakes. The foreman in charge is F. A. Lumby.

THE CREDIT FORKS MINING AND MANUFACTURING CO.

The above company, with offices in Toronto, is operating a number of quarries at the Forks of the Credit, and has been operating lime kilns at the same point. These are now closed, and work at the quarries was nearly suspended at the time

of my visit on Sept. 19, 1899. Preparations, however, were being made for extensive quarrying. The quarries are located on both sides of the deep gorge through which flows the Credit river, and are situated high up on the hillsides. An aerial tramway was in process of construction to convey stone from quarry No. 5 on the hill north of the village to the station on the C.P.R. (Toronto, Orangeville and Elora Div.). The operations of this company are of peculiar interest from the circumstance that for many years a portion of the stone extracted has been obtained by mining. The method of mining resembles that in use for coal, although the workings are of comparatively small extent. Two entries are driven into the face of the hill about 150 ft. apart. At a distance of from 25 to 40 ft., varying according to the strength of the rock, these entries are connected by a cross-drift. The winning of rock then commences. The brown sandstone constitutes the bottom bench. The upper bench is limestone, and between these two is an intermediate bench of shale, which forms the "bearing-in" bench. After its removal the limestone is shot down, and then the brownstone is extracted in the ordinary way. The working face is 160 ft. wide, and protection against roof-falls is afforded by temporary stulls. The culls, or waste, is thrown back between gob-walls, so that the gob (locally called "dirt") advances close enough to the working face to prevent collapse of the roof. An entry is kept open on each side of the gob, so that cars can enter through one and return to the surface by the other. It will be seen that by this system the cost of quarrying is little, if any, greater than in ordinary open quarries, and is very much less than in those where much stripping of surface debris is required. The officers of the company are, Pres't., Robt. Carroll, vice-pres't., J. B. Vick, sec., treas. and mgr., F. Beharriel, all of Toronto.

During the summer another small mine, extracting brownstone, was operated by W. Sharp, but this was closed in September.

SALT.

During the year a careful inspection of the salt industry was made, and subsequently analyses of samples of salt and brine have been conducted under my supervision by Mr. J. W. Wells at the Provincial Assay Office, Belleville. The results of my investigations, and of the analyses and experiments made at Belleville, will be given later in a separate report. The salt works visited were the following:—The Coleman Salt Co., Seaforth; R. & J. Ransford's Stapleton Salt Works, Clinton; North American Chemical Co., Goderich; The Goderich Salt Works, of Peter McEwen, Goderich; The Gray, Young and Sparling Co., Wingham; The Ontario Peoples Salt Co., Kincardine; John Fox and King Hodgins Salt Works, Park Hill; The Sarnia Salt Co., Sarnia; and The Windsor Salt Works, Windsor.

PEAT.

An inspection was also begun of the peat industry in Ontario, and numerous localities were visited. Tests of the peat are also being made at the Provincial Assay Office, Belleville, and the results of investigations in the field and the laboratory will be made the subject of a special report. The Canadian Peat Fuel Co., of Toronto, has given a strong impetus to this industry, which promises to become one of great importance to the Province.

MICHIPICOTON MINING DIVISION

By D. G. Boyd, Inspector

I have the honor to present to you herewith the third annual report on the Michipicoton Mining Division. During the past season the district has made steady advances in many directions. More development work has been entered upon, and, in the majority of cases, is proving very satisfactory. Mining machinery has been set up, of which the following may be mentioned,—A one stamp mill complete, on Claim No. 84, the property of the Hornblende Mining Company, and on the Minto mine, the property of the Wawa Gold Mining Company, a pumping and hoisting plant.

Post offices have been established at Wawa, Michipicoton River and Michipicoton Harbor (the lake terminus of the Algoma Central Railway). The Government road has been built between Little Gros Oap on lake Superior and Wawa village, and several good tote roads have been made by the miners to the various camps. In prosecuting work upon Helen claim, situated about one mile north of Wawa lake, an extensive body of brown hematite ore was uncovered, attention being thus drawn to this locality. The iron-bearing formation was traced a long distance, and numerous claims have been staked upon it.

Information reaching the Department that large bodies of valuable iron ore had been discovered in this Division, the Government resolved upon a temporary withdrawal from sale of these iron-bearing lands, pending an investigation with a view of ascertaining the extent of the ore deposits and obtaining other desirable information. This was pursuant to the provisions of an Order in Council, dated 10th July, 1899.

Dr. Coleman and Professor Willmott were appointed to make this investigation, and their summary report is given in the 8th Report of the Bureau of Mines, pp. 254 258. The withdrawal of the iron lands accounts for the large number of licensees who have not any claims registered, as they located claims in the iron-bearing lands in expectation of obtaining the claims staked when the lands are placed in the market again.

The Algoma Central Railway began construction of a railroad from Little Gros Oap to the Helen mine above mentioned, a distance of 12 miles. Ore docks will be built in the harbor, and it is expected that iron ore will be shipped continuously during the coming season.

The office at Michipicoton was opened for the transaction of business in one of the Hudson's Bay Company's buildings (the same one as occupied in 1898) on May 16, and continued open until November 14. During this period there were 187 miners' licenses issued, and 181 notices of mining claims filed.

The total number of licenses issued, including renewals for the year, was 252, 65 being issued from Toronto. The total number of claims staked and registered was 215, of which number 33 were registered at Toronto while the office at Michipicoton was closed during the winter months. The amount of money forwarded to the Treasury Department from the office at Michipicoton was \$3,014, and the amount received at Toronto was \$1,965, making a total of \$4,979. Of this amount, \$2,520 was received for miner's licenses, \$1,059 fees for additional mining claims, \$315 fees for transfers of claims, and the balance \$1,085 was paid in on account of patent fees at the rate of \$2 per acre by licensees who have fulfilled all the conditions required and desire to obtain a patent for their property.

Claims numbers 155, 156, 451 and 468 were visited by me on the 12th October. These claims are situated south of Wawa lake, and about five miles east of Michipicoton river, with which they are connected by a good tote road. The claims are being developed by the Edey Gold Mining Company of Ottawa, Limited, with Mr. R. W. Edey as manager, and John Wallace of Sault Ste. Marie as foreman. Work was commenced in the early part of spring and continued all season.

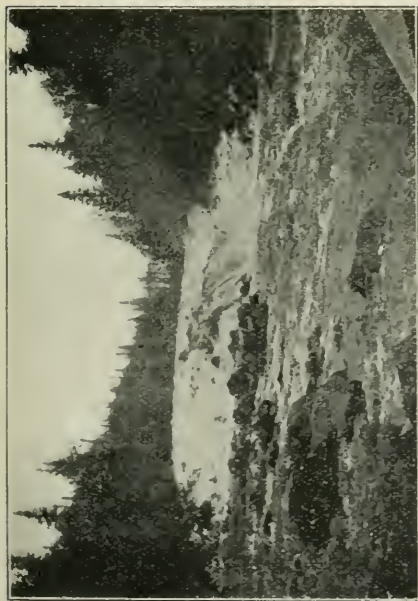
On claim 155 a shaft 7' x 8' x 25' deep has been sunk on the Blackinton vein, (so called after the discoverer), having a course of northwest and southeast, which has been traced through claims 155, 156, 451 and 319. The vein on this claim has been stripped in several places, and varies from two to eight feet wide on the surface.



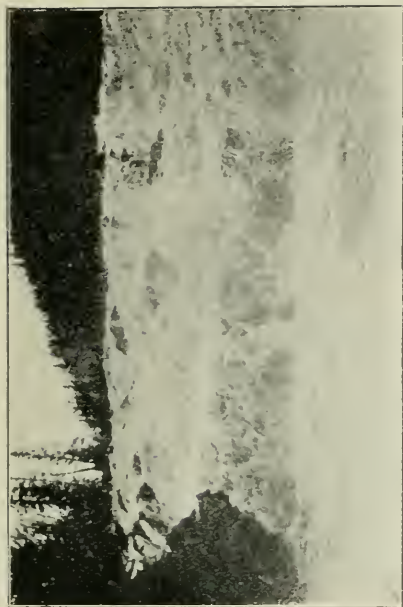
34. Tunnel and Shaft of Stella Gold Mine.



35. Tunnel of Gold Sun Mine, Crow Lake, p. 51.



36. Steel River Rapids near Ursa Major Gold Mine, p. 83.



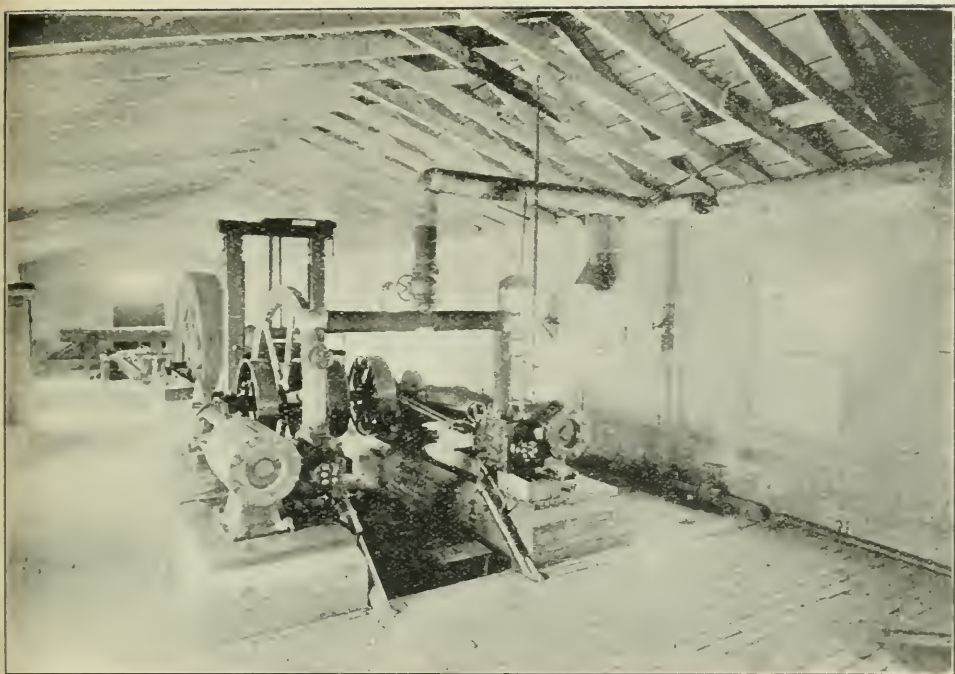
37. Falls on Steel River at Mountain Lake, p. 83.



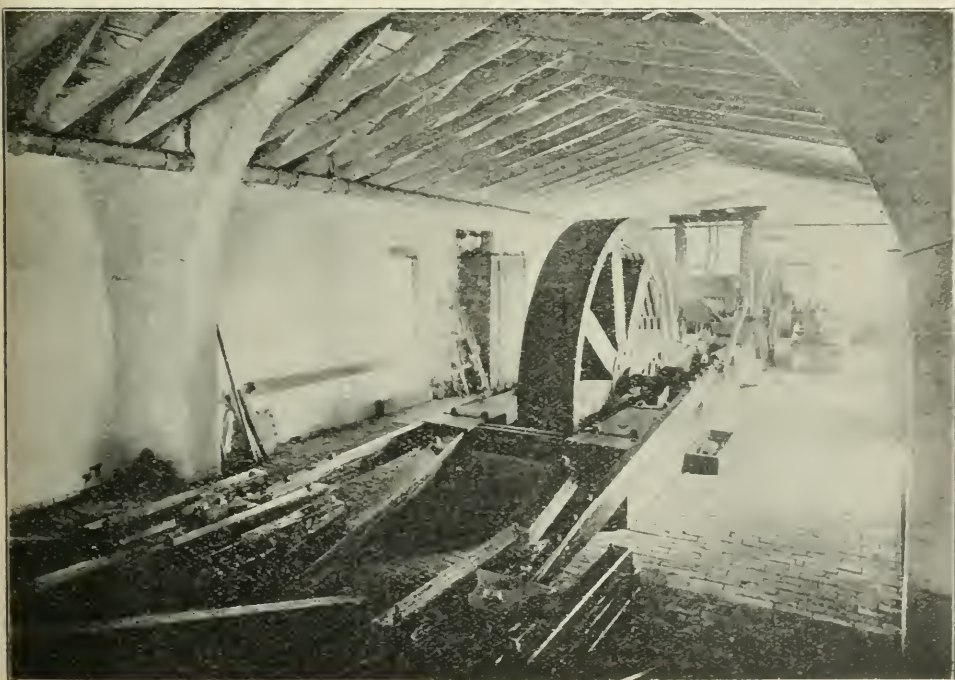
38. Open Quarry Work at Upper Pit on Lizard Vein, Ursa Major Gold Mine, p. 83.



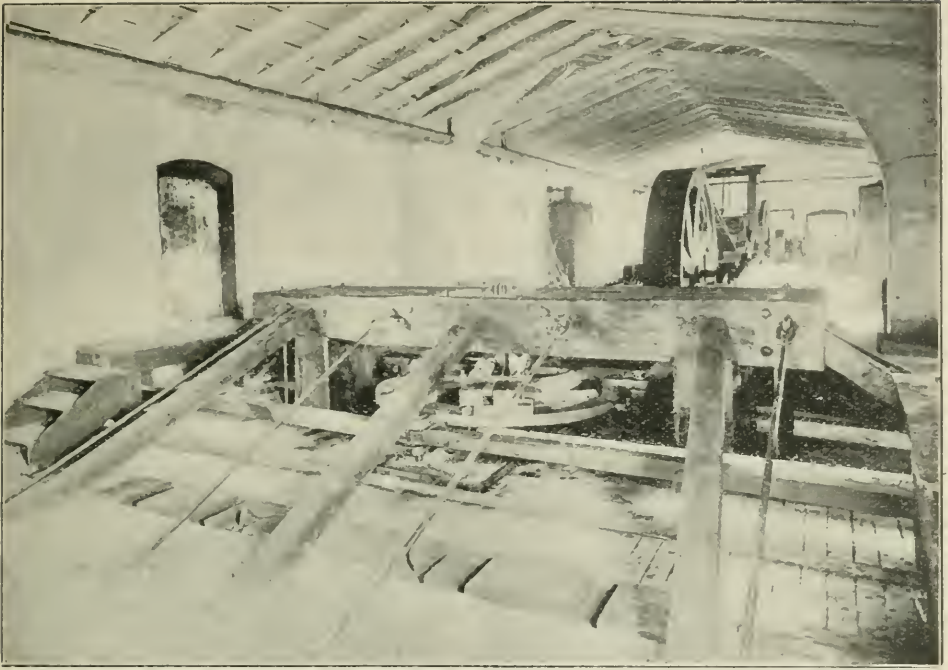
39. Ursa Major Gold Mine, Shaft and Crosscut, p. 83.



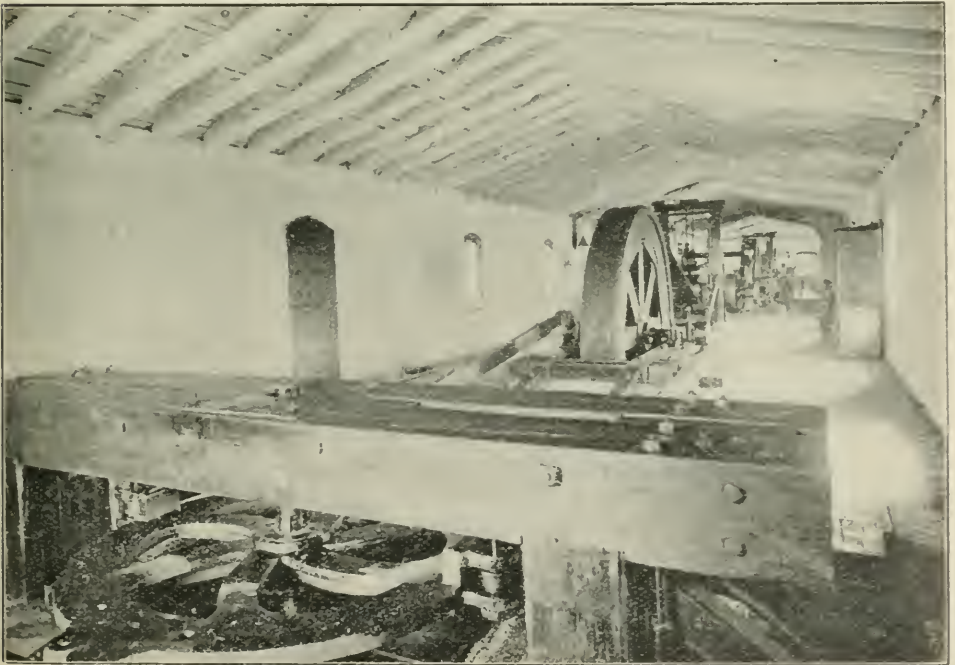
10. Power Plant of the Englehart Pumping System at Petrolea, looking south from "A" on Plan of Pumping Rig, p. 107.



11. Power Plant of the Englehart Pumping System at Petrolea, looking north from "A" on Plan of Pumping Rig, p. 107.



42. Power Plant of the Englehart Pumping System at Petrolea, looking south from "B" on Plan of Pumping Rig, p. 107.



43. Power Plant of the Englehart Pumping System at Petrolea, looking south from "C" on Plan of Pumping Rig, p. 107.

On claim "Lyla," No. 451, on the vein having a course nearly north and south, two shafts have been sunk seven by eight feet; one 23 feet deep, the other 11 feet deep. Besides the above mentioned shafts, the Edey Company have done considerable work in stripping and sinking test pits. A combined sleeping and cooking camp 18 by 20 feet, blacksmith shop and workhouse have been built.

On claim 447, situated three miles east of Michipicoton river, the same company have also sunk a shaft 7' x 8' x 57' deep, timbered down to a depth of 12 feet, and also have erected camps.

Claims No. 31 to 36, 502 and 503 were visited by me on October 19th. These claims are situated north of the Wawa lake, and were purchased by A. C. Ely of Chicago from A. Goetz. The work was combined on these claims and performed on claims 69 and 502. Mr. J. R. Van Evera of Marquette, Michigan, was manager, and he had with him as captain Mr. W. O. Uren. These claims are situated on the iron range and the work done was exploratory.

On claim 69 a shaft 8' x 10' x 21' deep was sunk in the country rock on the south side of Boyer lake, at the foot of a large hill.

On Claim 502 a trench 300 feet long, two feet wide, was dug down to the solid rock across the iron formation, and a test pit 5' x 7' x 6' deep was also sunk.

On R733 (surveyed) a pit 8' x 6' x 16' deep was sunk, and a tunnel 7' x 6' x 24' long was driven, both being in the country rock, and a trench 800 feet long and three feet wide was dug across the iron formation.

Close to the line between claims 68 and 502 a trench 100 feet long and three feet wide was dug, and a pit 5' x 7' x 6' deep was sunk.

None of these operations disclosed the presence of any ore body. The properties are being thoroughly tested by a diamond drill during the winter.

Claim No. 68 "Helen Iron Mine", was visited on 19th October. This property has been described by Dr. Coleman, see Bureau of Mines Report for 1899, pp. 254-255. It is owned and managed by Mr. E. V. Clergue, who has Mr. T. Williams as captain.

The development consisted in stripping off the earth, moss, trees, etc., which covered the deposit, sinking nine pits 7' x 3' from 4' to 24' deep, and determining the extent of the deposit. On the southern boundary a tunnel $6\frac{1}{2}'$ x 4' x 45' long, has been driven.

On the point in Boyer lake, where the bulk of the ore is, two open cuts have been made, one on the north side 100 feet long, 20 feet wide and 25 feet face, and on the south side 100 feet long, 40 feet wide and 30 feet face. A drift has been started in the ore on a level with Boyer lake, $7\frac{1}{2}'$ x 5' x 24' long. The camps used during the summer were built for temporary occupation.

Claim "Lincoln," No. 415, was visited on 25th October. This claim is owned by Andrew Brown of Sault Ste. Marie, who has charge of the work. The vein is a contact one between the two formations. Its course is northwest and southeast, dipping 45 degrees to the north. The average width of the vein on the surface is 4 feet; it is well mineralized with iron and copper pyrites with frequent showings of free gold. One shaft 6' x 8' x 35' deep has been sunk, and 400' southeast of the same vein another shaft 6' x 8' x 20' deep.

An eating and cook camp 16' x 30', sleeping camp 15' x 20' and blacksmith shop have been built. A contract for 100 feet of additional sinking in pit No. 1 has been let to Messrs. Brown and J. B. Johnston, which will be done this winter. The property is under an option for sale to a company composed of Bowling Green, Ohio, parties.

Claim "Peru", No 315, situated on the same vein was visited on the same day. The vein has been traced across the claim and stripped in several places. A pit 6' x 7' x 13' deep has been sunk. This claim is owned by Mr. R. Rush of Echo bay, who had his brother, Mr. W. Rush, developing his claim.

Claims 300, 494 and 564 were visited on 13th October. These claims are part of a group which are owned and operated by the Guelph Mining Company, Limited. Mr. Wm. Husson is in charge. On claim 300, on a vein 4 feet wide, with a course of about east and west, a pit 6' x 8' has been sunk 14 feet deep. On claim 494, a pit 6' x 7' x 27' deep has been sunk on a vein which has been traced through three claims on a course of

northeast and southwest, well mineralized with iron and copper pyrites. On claim 564, a pit 6' x 8' x 30' deep has been sunk on a vein which has been traced for 20 chains, and which varies from 4 to 6 feet wide, with a course of northwest and southeast; it dips to the northeast and is well mineralized.

"Gananoque," claim No. 128, is owned by the Gananoque Gold Mining Company, Limited, with Joshua Legge in charge. A tunnel at the foot of a hill has been driven 5 feet wide and 14 feet high, a distance of 34 feet, following the course of the vein. Half way up the hill another tunnel has been driven 7' x 8', 22' into the country rock to try and catch the vein. A large amount of work was done in clearing off the overhanging rocks above the tunnel at the foot of the hill.

Claim No. 480, is owned by the Corona Mining Company, Limited, with Mr. W. H. Wylie as manager. On a large vein with a strike of west-northwest and east-southeast, which has been traced from Wawa creek across to Michipicoton river, the vein matter is about 180 feet wide, consisting of a mixture of quartz and slate. A shaft 6' x 8' x 23' deep has been sunk all in quartz, which is heavily mineralized with iron and copper pyrites, with traces of mispickel and zinc blende. A camp 16' x 28', and blacksmith shops have been built. On the same vein, on claim 634, situated on Wawa creek, a tunnel was driven 13 feet. Claim "Cora," No. 26, is owned by H. W. Evenden, and worked by the Johnston brothers of Sault Ste. Marie, Ontario. On a vein, course nearly north and south, dipping 43 degrees to the east, two shafts have been sunk, the southerly one being 8' x 10' x 32' deep. The other is 100 feet north, and is 9' x 12' x 16' deep. A camp and blacksmith shop have been built. This claim was visited October 30.

On claim 84, visited October 30, and owned by The Hornblende Mining Company, Limited, a shaft 7' x 7' x 22' deep has been sunk. A stamp mill has been erected, and the following machinery installed,—15 h. p. engine, 16 h. p. upright boiler, small Blake crusher, Nissen's ore feeder, Nissen's gravity stamp, 1,300 pounds, with a capacity of from 6 to 7 tons per day of 24 hours. The special feature about the mill is that it has a circular mortar. The mill building is 16 by 27 feet. At the time of my visit all the machinery was up and connected, but had not been in operation. Sleeping and cooking camps were built, and the office and manager's house were being erected. Mr. P. N. Nissen is manager.

On claim 52, which is owned by the same company, a shaft 6' x 8' x 32' deep has been sunk. It was the intention of the company to put in another mill as soon as possible.

At Mackey's Point, Y 103, at the time of my visit on October 30, the pits were full of water. The following particulars were given to me by Mr. J. J. Mackey. A shaft 8' x 10' x 40' deep has been sunk, and at the 40 foot level a crosscut 6' x 8' x 30' long has been run. Another small pit is down 6' x 8' x 14'. Cook and sleeping camps have been built.

Claims 92, 93, 94 and 95, the Minto mines, owned by the Wawa Gold Mining Company, Limited, were visited on October 30. Work was mostly preparatory for mining on a large scale. A working shaft was sunk on the edge of a small lake, 6' x 11' x 42' deep. This has been timbered to a depth of 25 feet, with an excellent collar. The following buildings were erected,—cook and dining camp and root house, 24 by 36 feet, store-house, 16 by 20 feet, sleeping camp, 1½ stories, 16 by 30 feet, office 1½ stories, 20 by 20 feet, shaft-house and dry-house, 18 by 30 feet, blacksmith house, 14 by 16 feet, stables, 17 by 27 feet and engine house 14 by 16 feet. The following machinery was installed,—18 h. p. engine with hoisting attachment and upright boiler; also Northey pump with a capacity of 150 gallons per minute.

On the Jubilee claim No. 75, the shaft was sunk to a depth of 103 feet during the winter. The work was suspended all through the summer.

Other properties were visited, but the work done was not of sufficient importance to be noted here.

Appended is a list of licensees, place of residence, number of license, and number of claim (if any). Where not otherwise indicated the licensees are residents of Ontario. Claims marked with an asterisk (*) are in dispute.

LIST OF LICENSEES.

Name.	Residence.	License No.	Claims.
Abell, J.	Toronto	523	278, 373, 676.
Allan, J.	S. S. Marie.....	618	684, 685, 686.
Allan, J. G.	Hamilton	554	608.
Andrie, G.	Michipicoton River.....	578	
Andrie, Mrs. G.	"	655	
Armstrong, H.	"	506	629.
Armstrong, H.	Iron Mountain, Mich.	500	
Armstrong, L. O.	Montreal	460	
Bacon, B. T.	Chicago, Ill.	600	
Barton, S.	S. S. Marie.....	648	533, 688.
Bartlett, E. T.	Montreal	517	613, 637.
Bauldry, W. J.	Wawa	577	
Beaudry, G.	Wawa	586	
Becker, O.	Michipicoton River.....	570	642, 652.
Beebe, W. D.	Pleasantville, Penn.	508	555, 627, 694.
Beirnes, J.	Guelph	526	
Blackinton, A. B.	Michipicoton River.....	637	282.
Bole, B. P.	Cleveland, O.	601	
Bousquet, J.	Wawa	656	
Bowden, J. L.	S. S. Marie.....	687	
Bowie, N.	Wawa	591	
Boyd, J. F.	Thessalon	471	377, 651.
Boyd, W. S.	S. S. Marie.....	683	258.
Boyer, B.	"	641	360, 425.
Brooks, Annie.	Michipicoton River.....	519	571.
Brooks, T. H.	"	518	587.
Brotherton, G. H.	Port Arthur.	582	
Brown, A. F.	S. S. Marie.....	659	113, 415, 696, 697.
Brown, Jane	"	544	535.
Bryan, H. J.	"	569	650, 675, 690.
Burley, T. S.	Missanabie	487	582.
Bush, C.	S. S. Marie.....	681	273, *542.
Bush, jr., C.	Hamilton	552	607.
Bush, Flora	"	553	
Cameron, A.	White River.....	626	
Chitty, A. H.	S. S. Marie.....	686	
Clark, E. D.	Guelph	672	200.
Clergue, B. J.	S. S. Marie.....	605	
Clergue, E. V.	"	548	68, 70, 71, 190, 191, 510, 511, *512 513, 514, 515, 516, 584, 585, 600, 667, 700.
Clergue, F. H.	S. S. Marie.....	562	671, 703.
Clergue, Frances.	Bangor, Maine	708	
Clergue, Gertrude	"	699	
Clergue, Grace.	"	698	
Clergue, Helen	"	697	
Clergue, J. H.	"	606	
Cochrane, R. B.	Marquette, Mich.	565	618, 680.
Conlon, J. A.	Thorold	587	
Corona Mining Co., Limited.	Almonte	545	434, 480, 322, 417, 617, 633, 644, 662.
Cory, E. N.	Pennville, Indiana	579	557.
Coughlin, R.	Michipicoton River.....	546	606, 658, 659.
Culbert, D. S.	Wawa	489	276, 528, 529, 545.
Davidson, J.	Ottawa	677	129, 547, 616, 665.
Derry, P. A.	S. S. Marie.....	566	416, 538, 539.
Dion, Mary L.	Wawa	480	508, 572.
Donovan, H. A.	"	485	668.
Douglas, E. A.	Michipicoton River	510	575, 602.
Douglas, E. V.	Philadelphia, Penn.	700	
Douglas, J.	S. S. Marie.....	537	578.
Douglas, P.	Hawick, G. B.	580	
Douglas, W. P.	Philadelphia, Penn.	702	
Downey, L.	Chapleau	563	469, 492, 683.
Dowrie, R.	Guelph	458	
Dreany, A.	North Bay	581	
Drew, T. F.	Wawa	755	702.
Driver, J.	S. S. Marie.....	567	380, 588, 589.

LIST OF LICENSEES.—Continued.

Name.	Residence.	License No.	Claims.
Drummond, H. A	Toronto	484	612.
Dunn, C. B	Paterson, N. J	568	
Dyckie, J. G	Michipicoton River	498	490, 648.
Dyckie, Margie	"	711	628.
Eccles, Ida	S. S. Marie, Mich	525	701.
Edey Gold Mg. Co., Limited.	Ottawa	488	451.
Edey, M. C	"	673	155, 594, 656, 673.
Edey, R. W	Michipicoton River	675	468, 475, 447, 595, 654, 674.
Ely, A. C	Chicago, Ill	535	31, 32, 33, 34, 35, 36, 69, 502, 503
Emmerson, J. T	Port Arthur	595	
Enniskillen Mg. Co., Limited	S. S. Marie	630	669, 670.
Evenden, H. W	Campement D'Ours	462	26, 27.
Everett, H. L.	Philadelphia, Penn	634	450, 454, 455, 471.
Flanagan, J	Wawa	468	660.
Fee, G	North Bay	670	
Fleming, S. E	S. S. Marie	619	682.
Gananoque Gold Mg. Co....	Gananoque	609	128, 264, 269.
Ganley, Jas	S. S. Marie	496	581, 630.
Ganley, Jos	"	642	
Gaudette, C	"	521	299, 583.
Gemmell, L. J	Perth	467	
Georgi, J	Michipicoton River	610	537.
Gilmore, D. B	Toledo	513	275.
Gilmore, S. M	"	668	199, 465.
Gilmore, W	"	514	332.
Godon, T	Missanabie	547	354.
Goetz A	S. S. Marie, Mich	611	631.
Goetz, G	Detour, Mich	572	
Goetz, Johanna	"	461	
Goetz, Mary	"	571	
Goetz, Mrs. P	S. S. Marie, Mich	613	
Goetz, Ruth	"	612	
Gravell, A	S. S. Marie, Ont	551	381.
G. N. M. E. & D. Co., (Ltd.)	Toronto	491	38, 75, 103 ($\frac{1}{2}$ int. in each) 449, 486
Grover, M. B	Wawa	479	
Guelph Mg. & Dev. Co	Guelph	682	202, 300, 494, 495, 563, 564, 566, 604, 621, 706, 620.
Hagedorn, C. K	Berlin	706	
Hall, W	S. S. Marie	559	
Hall, C	"	666	
Hamilton, H. C	"	703	
Hamlin, F	Chicago, Ill	665	
Hamwell, A. M	S. S. Marie	639	
Harrison, W. L	New York (city)	667	
Harvey, A	Chapleau	628	292.
Harvey, J	Hamilton	594	
Hassard, A	Toronto	472	609.
Holbrook, B	Wawa	564	530.
Holbrook, Leila J	Watford	588	693.
Holding, R	Kingston	477	570.
Holiday, W	Port Arthur	608	
Hopkins, Anna J	Pleasantville, Penn	507	72, 97.
Hopkins, H. J	Buffalo, N. Y	679	99.
Hornbleade Gold Mg. Co., Limited	Toronto	486	84, 52, 487, 493, 504, 505, 529, 599
Hunt, J	Rydal Bank	625	491, 509, 626.
Husson, W	Guelph	671	202, 517.
Irving, T. C	Toronto	662	
Irving, jr., T. C	Michipicoton Harbor	663	
Johnston, A	Pembroke	541	168, 169 ($\frac{1}{2}$ int. in each) 590.
Johnston, T	S. S. Marie	629	541.
Jelley, J	Webbwood	685	
Kimball, Hattie	Michipicoton River	638	418, 534.
Kimball, Wm	"	497	551.
Kitely, H	Toronto	646	462.

LIST OF LICENSEES.—Continued.

Name.	Residence.	License No.	Claims.
Labelle, J	Michipicoton River.....	504	536, 550.
Lands Corpor'n of Mich'n., Limited	Toronto	645	
Laughton, M	S. S. Marie.....	575	
Lauzon, A.....	"	457	1 int. in 38 & 75, $\frac{1}{2}$ in 103, 408, 560
Law, S	Guelph.....	502	
Lawlor, J.....	Salem, Oregon	511	573, 598, 624, 641.
Lawlor, J. H	S. S. Marie.....	652	$\frac{1}{2}$ int. in 38 & 75, $\frac{1}{2}$ in 103, 681, 687
Legarde, F	Michipicoton River.....	490	
Legge, C. H.....	Gananogue.....	644	522, 678.
Legge, J.....	"	639	521, 160.
Lewis, jr., A. E	Milford, Penn	635	178, 427.
Lewis, F	"	532	430.
Lewis, F. I	Philadelphia, Penn	701	
Lewis, W. H	Detour, Mich.....	538	318, 319.
Lincoln, J. C.....	Bowling Green, Ohio	543	580.
Mackey, J. E	Wawa	631	
Mackey, J. J	"	657	
Mackey, R. E	North Bay	669	
Madge, P	Thomes Road.....	466	666.
Malcolm, W.....	Collingwood	503	548, 558, 559, 640.
Manitou Mineral Co.....	Niagara	654	634, 643, 661, 689.
Martin, H. G	Wawa	636	647.
Maxwell, C. F.....	St. Thomas.....	531	553, 610.
May, E	Michipicoton River.....	528	325, 695.
Mead, F	Flushing, Ohio	617	672.
Merrick, W. C	Cleveland, Ohio	603	
Miller, R. J.....	St. Thomas	530	554, 611.
Mitchell, J	Guelph	501	520, 565, 622.
Mitchell, Mary E	"	520	567.
Monsarrat, N. S	Cleveland, Ohio	632	
Moran, P	S. S. Marie, Mich.....	622	
Moran, Mrs. P	"	623	
Morin, J	Hamilton	473	518, 543.*
Morris, Zoie.....	Morrisonville, Ill	573	
Murray, T. H.....	S. S. Marie, Ont.....	493	574, 576.
Murray, W. P.....	Cleveland, Ohio	597	
McCue, W	Wawa	592	
McDougall, L.....	White River	627	
McDougall, W. H.....	"	590	
McGillivray, W	Ottawa	674	156, 592, 597.
McGrath, M	Michipicoton River.....	709	
McHardy, J. A	Guelph	459	
McKay, Annie	S. S. Marie.....	576	
McKeehan, H. H	Cleveland, Ohio	593	
McLean, A	Wawa	469	
McLeod, D	Guelph	527	
McMichael, A. F	Toronto	515	615, 635.
McRae, P. J	Detour, Mich.....	539	347, 456.
Newton, G. J	Guelph.....	556	
Noel, J	Missanabie	463	317, 531, 532.
O'Brien, W	S. S. Marie.....	529	298.
O'Hara, J. C	Duluth	615	
Osborne, C. S	S. S. Marie, Mich.....	640	437.
Parkes, Mrs. A. W.....	St. Catharines	483	524, 527.
Parr, Mrs. S.....	Battle Creek, Mich	589	699.
Pattee, G. I.....	Michipicoton Harbor	653	
Pellow, H.....	Chapleau	550	601.
Perry, W. F.....	Wawa	549	
Pilkie, R.....	S. S. Marie	692	
Pimm, C.....	"	481	
Pol, B.....	Bangor, Maine	664	
Pol, Josephine.....	"	696	
Pol, Frances.....	"	707	
Preneval, G.....	S. S. Marie.....	492	561, 632.
Quigley, G. B	Bowling Green, Ohio	660	195, 579.

LIST OF LICENSEES.—*Concluded.*

Name.	Residence.	License No.	Claims.
Ralph, M	Duluth, Minn	536	623.
Reed, G	Michipicoton River	658	653, 707.
Rogers, G. H	Ottawa	676	593, 655.
Rogers, J. W	S. S. Marie, Mich	540	
Roth, F	Cleveland, Ohio	678	253.
Russell, A. L	Port Arthur	596	
Rush, R	S. S. Marie, Ont	478	336, 540.
Sayer, J	Garden River	620	308.
Saults, Mrs. W. W.	Goderich	482	526.
Scott, J	Nipigon	558	
Seneca Gold, Copper & Nickel Co., Limited	Welland	534	457, 458, 459.
Seymour, W. L.	Chicago, Ill	599	
Simmons, N	S. S. Marie	494	519.
Simpson, N	"	704	
Sjostedt, E	"	560	704, 705.
Sleeman, G	Guelph	475	
Smart, T. K.	Wawa	470	507.
Smith, R. H.	"	474	
Snell, W. M.	S. S. Marie, Mich	649	691, 692.
Snider, E. B. W.	St. Jacobs	705	
Steese, R. C.	Youngstown, Ohio	464	500.
Stewart, J	Pembroke	542	168, 169 ($\frac{1}{2}$ int. in each.) 591.
Stone, R	S. S. Marie	691	
Superior Gold & Copper Co.	Toronto	647	461.
Sutherland, J. G	S. S. Marie	688	
Swift, H. S	Duluth	661	
Talbot, H. E.	Dayton, Ohio	607	
Talbot, K. H.	"	616	
Teare, J. H.	S. S. Marie	505	577, 619, 625, 646.
Thibault, N	"	533	337.
Thompson, D. S.	Hamilton	555	603.
Thompson, F.	S. S. Marie	693	
Thompson, R.	"	694	
Towers, T. A. P.	"	621	664.
Townley, W. B.	Toronto	516	614, 636.
Travers, R.	S. S. Marie	624	
Trembley, Jos.	Toledo, Ohio	643	49.
Van Evera, J. R	Marquette, Mich	604	
Vansickle, W. B.	Lynden	499	301.
Walker, J. W.	Creemore	509	552.
Wallace, J.	S. S. Marie	522	549, 596.
Ward, A.	Botona, Iowa	574	
Ward, L. M.	Wawa	650	98, 378, 556, 568.
Ward, Myrtle	Pleasantville, Penn	661	460.
Ward, Venia, A.	"	476	546.
Ward, W.	"	495	281, 391, 569.
Warren, S.	S. S. Marie	690	
Washington, S. F	Hamilton	512	*544.
Wheeler, C. P.	Chicago, Ill	598	
Wick, H.	Cleveland, Ohio	465	499, 501.
Wight, J	S. S. Marie	684	226.
Wilke, J. A.	"	561	
Wiley, F. S.	Port Arthur	584	
Wiley, H. A.	"	583	
Wilfing, F. J.	S. S. Marie, Mich	633	102.
Wilson, W. J.	Michipicoton River	557	
Wilson, W. J.	S. S. Marie	614	444.
Worthington, C. P.	"	695	
Wylie, W. H	Niagara	680	586, 649, 698.
Younkin, F	Jackson, Mich	632	387.

ARE THERE DIAMONDS IN ONTARIO?

By Archibald Blue.

In this last decade of the century it has been dawning upon ourselves, and more slowly upon other people, that Ontario is a mineral country. In former times our own people were led to believe that they must depend on the resources of the field and the forest for livelihood, and there was no lack of proofs that for the farmer and the lumberman our Province was an ideal land for large possibilities. I am sure there was not in the whole of America another country of equal extent where there grew trees of such girth and height as in the tracts lying between the river St. Lawrence and the Ottawa, between lake Ontario and Georgian bay, and between lake Erie and lake Huron. Within the lifetime of one man that great forest has been cut away, and in its place are fertile fields, producing sustenance for two millions of people, and much for export besides. Moreover, the farmer of today is a manufacturer as well as the producer of raw materials. He is not now content with growing wheat, oats and hay, as the pioneer was, and depending on his surplus of these crops for the profits of his industry. He converts grass and grain into beef, pork and mutton, poultry and eggs, butter, cheese and wool; and so earns a second series of profits, saves on freight, and keeps up the fertility of his soil. Mixed farming and intensive farming go together, and although larger results are possible, it is gratifying to know that, as compared with any other Province or State on the continent, Ontario is easily first. This is one thing established by eighteen yearly reports of the Bureau of Industries, and if that Bureau had done nothing else it would have justified its *raison d'être*, its right to be. There has been given to our people a reason for settled confidence in the lands they till and the country they occupy; and, in so far as these convictions go, we have the assurance of a stable population. In the New Ontario of the north there remains a region of much greater magnitude to occupy and possess, and in its resources of soil and timber another two millions of people may find support and occupation. But if to soil and timber be added its unopened stores of minerals contained within an area of 100,000 square miles, and if the manufacturing idea takes possession alike of miner, woodman and husbandman, one can only say that we have the domain for a great Kingdom.

Taking the Old and the New Ontario together, there is a mineral bearing belt that extends 1000 miles, from the river St. Lawrence to the Manitoba boundary. It is the backbone of the world, and has borne the stress and strain of unnumbered cataclysms. It is a mountain built country, where the mountains have been cut down to hills, and the hills to plains. The thickness of some of the older formations is measured in miles, and they have been twisted, folded, fractured, crumpled during the long ages of secular cooling into more forms than fancy can conceive or pen describe. There are great areas of igneous as well as sedimentary rocks, and almost everywhere throughout the wide country are to be seen conspicuous evidences of disturbance, deformation, degradation and reconstruction. It is just the character of country in which a keen prospector for minerals would expect to find them in quantity and variety, and during this decade he has been awarded with discoveries from one end of the belt to the other. Nickel and copper, iron and gold, graphite and mica, may be said to occur abundantly. Corundum also is now proven to exist in a tract of 400 or 500 square miles in extent, and where corundum is we may hope to find the gem forms of it, sapphire and ruby. There is, however, one mineral of the first rank of utility which we have not. Our Province emerged too early from the sea, and has stayed too persistently out of it, to favor the coal measures. We have neither anthracite coal nor bituminous. But may it be possible that in the bounty of Nature's compensations we have the pure carbon element in its gem form, the diamond? Are there diamonds in Ontario?

Interest and curiosity in this question have been aroused by papers published during the past year in two American magazines of good repute as scientific authorities. In the *Journal of Geology* for May-June Professor William Herbert Hobbs of the University of Wisconsin has dealt with it in an article entitled the *Diamond Field of the Great Lakes*; and in *Appleton's Popular Science Monthly* for November the same writer

discussed it in an article on Emigrant Diamonds in America. He had also written upon it in 1894 in the *American Geologist*, and has referred to it in other publications. Briefer notices have appeared at intervals in official reports and scientific records during a period of more than thirty years of isolated discoveries of diamonds in earth beds, rock debris and drift deposits in the Atlantic, Pacific and Northern States, and mention may first be made of these as having precedence in the order of time.

DISCOVERIES IN THE UNITED STATES.

There are newspaper accounts of the finding of diamonds in Virginia and North Carolina nearly fifty years ago; but the most authentic reports are in a paper by Dr. Genth on the Minerals of North Carolina, published in the *Journal of the Franklin Institute*, November and December, 1871. The suggestive statement is there made that the diamonds were discovered in debris of old gneissoid rocks, in which graphite is always found. George F. Kunz of New York, who is an expert on precious stones, gave in the volume of *Mineral Resources of the United States for 1883-4* accounts of a number of discoveries of diamonds in California, which usually were found in gold mines when cleaning up sluices or while washing off the bed rock, though in a few instances they were picked up on the surface. Fragments of diamonds had also been noticed in the tailings from quartz mills, being the remains of stones which had been broken under the stamps. In one locality they were found in the gray cemented gravel underlying a stratum of so-called lava or compact ash; but usually the gravel was mixed with lava, ashes or other volcanic matter, which gives a hint of the source of the stones. The paper of Mr. Kunz gives the first official notice of the finding of a diamond eight years before (in 1876), at Eagle, Waukesha county, Wisconsin, it having been thrown out with a bucket of gravel by a well-digger from a depth of 60 feet. This was the first Wisconsin diamond, and it weighed 15 carats, but was slightly off color. "Having carefully examined a quantity of the gravel sent to different persons," Mr. Kunz wrote, "I have failed to find anything but the regular debris from glacial drift." One of the best methods of prospecting a new district for diamonds, in his judgment, is to familiarize the searchers with the lustre of real stones, for which purpose small imperfect crystals sold at \$5 to \$10 will suffice. "Several thousand searchers thus prepared would soon ascertain whether diamonds really existed, and the crystal would also serve for testing the hardness of the stone as well as the lustre."

Prof. Hobbs has given a careful account of discoveries of diamonds in glacial drift since the finding in 1876 of the stone of 15 carats at Eagle, Wisconsin, mentioned by Mr. Kunz, to the finding of one weighing 6 carats of purest water at Milford, Ohio, in 1897. A tenant farmer's wife kept the Eagle stone seven years as a curious thing, and without faith in the old-word "keep a thing seven years and turn it over," she sold it to a Milwaukee man in the jewelry business for one dollar. The jeweler submitted it to an expert, and was told that it was a diamond. Then the woman offered to repurchase it for \$1.10, and being met with a refusal, she brought suit to recover its full value. The case was finally carried to the Supreme Court of the State, where a decision was given in favor of the jeweler on the ground that he, no less than the woman in whose well it had been found, and who had kept it as a curious thing seven years, had been ignorant of the value of the gem when he bought for a dollar. That stone has been purchased by Tiffany & Co. of New York, and is still uncut in the Tiffany collection. Another of the interesting incidents in the story of the Eagle stone is, that the discovery of it led to the booming of the property for diamond mines. In 1886 another stone was found by a farmer of Kohlsville, Wisconsin, while ploughing in his field, and it is still owned by his widow. The weight is $21\frac{1}{4}$ carats. In the years 1887, 1888 and 1889 the gravel bed of Plum creek in Wisconsin was prospected for gold, and ten or more diamonds were found weighing from $\frac{1}{2}$ carat to 2 carats each, besides a number of microscopic size. They were associated in the water-worn gravel with garnets, gold and platinum. Some were colorless, some bluish and others yellowish. Late in 1893 a white diamond weighing nearly 4 carats was brought to Prof. Hobbs by a farmer of Oregon, 12 miles south of Madison. The farmer's little son had found it while playing in a clay bank. It was this discovery that awakened the Professor's interest in the subject of diamonds, and to it we are indebted for a number of valuable papers from his pen. Another diamond, reported to

have been found at Burlington, Wisconsin, came into notice in 1893, but no particulars of it have been learned. In 1894 a stone weighing almost 11 carats was found in the glacial drift at Dowagiac, Michigan, on the Michigan Central Railway, between Niles and Kalamazoo. The next reported find was in 1896, by a German farmer at Saukville, Wisconsin, but it had been in his possession 15 or 16 years. It was a white diamond of $6\frac{1}{2}$ carats. The latest discovery mentioned by Prof. Hobbs was the one at the town of Milford, near Cincinnati. "No less than seventeen identified diamonds," he writes in the *Journal of Geology*, "varying in weight from $\frac{1}{2}$ carat to 2 carats, have been discovered in the region of the Great Lakes of North America. That a considerable number of others have been found, which have not been reported because they have escaped identification, hardly admits of reasonable doubt when it is borne in mind that three of the stones found (including the two of largest size) remained in the hands of the farming population without their nature being discovered for periods of eight and one half, seven, and over fifteen years respectively. If it were possible to visit all the houses in the lake region," the Professor goes on to say, "I have no doubt that many diamonds would be discovered in the little collections of pebbles and local curios which accumulate on the shelves of country farm houses." We have all seen these little collections of "lucky stones," as they are often called—or at least all of us who have visited at or lived in country homes—and to help in distinguishing diamonds from other stones (for we in Ontario are also in a morainic region) the following extract from Prof. Hobbs' paper in *Appleton's Monthly* may prove useful:

"Diamonds never appear in thoroughly rounded forms like ordinary pebbles, for they are too hard to be in the least degree worn by contact with their neighbors in the gravel bed. Diamonds always show, moreover, distinct forms of crystals. They are never in the least degree like crystals of quartz, which are, however, the ones most frequently confounded with them. Most of the Wisconsin diamonds have either twelve or forty-eight faces. Crystals of most minerals are bounded by plane surfaces—that is to say, their faces are flat—the diamond, however, is enclosed by distinctly curving surfaces. The one property of the diamond, however, which makes it easy of determination is its extraordinary hardness—greater than that of any other mineral. Put in simple language, the hardness of a substance may be described as its power to scratch other substances when drawn across them under pressure. To compare the hardness of two substances, we should draw a sharp point of one across a surface of the other under a pressure of the fingers, and note whether a permanent scratch is left. The harder substances will always scratch the softer, and if both have the same hardness they may be made to mutually scratch each other. Since diamond, sapphire and ruby are the only minerals which are harder than emery, they are the only ones which when drawn across a rough emery surface, will not receive a scratch. Any stone which will not take a scratch from emery is a gem stone, and of sufficient interest to be referred to a competent mineralogist."

All of the diamonds described in Prof. Hobbs' papers were obtained from deposits of glacial drift, except those found in the bed of Plum creek, which is in the near vicinity of glacial deposits. The localities of the discoveries are distributed over an area of 600 miles in length by 200 in breadth, and six or eight of them lie within an area of 200 miles square, with its centre near Milwaukee. Another important point is, that nearly all the localities are upon or near to kettle moraines. But before going on to deal with the probable source of the diamonds of these moraines, the question of origin will be considered.

ORIGIN OF DIAMONDS.

In the view of Dana and other authorities, the diamond has probably proceeded like mineral coal and oil from the slow decomposition of vegetable material, or from animal matters which afford the requisite carbon. But it must have been formed under like conditions of heat as those which produced the metamorphism of argillaceous and arenaceous shales, and their auriferous quartz veins, as it is found exclusively in gold regions or in the sands derived from gold-bearing rocks. The schists that were altered at the time may have previously been shales impregnated with petroleum, bitumen or other carbonaceous substances. In the humid oxidations of carburetted hydrogen, Dana says, the hydrogen is oxidized, part of the carbon becomes carbonic acid, and the rest remains

as carbon and may form crystallized diamond, just as sulphur is formed from hydrosulphuretted emanations. It has been observed, however, that the diamond crystal often contains microscopic cavities so numerous in some stones as to render them nearly black, and under polarized light it shows evidence of compression, "as if from pressure in the included gas when the diamond was crystallized." In Brazil and the Urals the stone generally occurs in regions having a laminated, granular, friable quartz rock called itacolumite, while in South Africa it is found in place in a matrix commonly known as blue ground.

DIAMONDS IN SOUTH AFRICA.

The first diamond workings in South Africa were commenced about a third of a century ago, in the gravel beds of the Orange and Vaal rivers, and in 1870 the dry diggings where the town of Kimberly now stands were discovered. Within a radius of $3\frac{1}{2}$ miles four mines began to be worked under conditions unlike those of any other known locality. What were at first supposed to be alluvial deposits were shown by the workings to be the vents or pipes of extinct volcanoes. The smallest of the four, known as De Beers mine, has a surface area of 22 acres, while the largest, known as Du Toits Pan, has an area of 45 acres. Operations were at first carried on by excavations of the diamond-bearing material, which for some distance from the surface was a soft yellowish earth that crumbled readily when exposed. At 100 feet it became darker and harder, acquiring a slate blue or dark green color, and resembled some varieties of serpentine. It is greasy to the touch, like serpentine, and is full of fragments of slate and other rocks. When exposed to the sun for some time it is readily crushed, and the diamonds are extracted by washing. In the De Beers mine two years ago the lowest workings had reached a depth of 1,500 feet, the method of mining adopted being to sink a shaft through the country rock and drive levels into the vent for stoping. In this way facilities have been afforded for a study of the geology of the Kimberley mines, but the scientists have not yet reached a stage of agreement upon all points. The shales which form the country rock underlie the district for many miles in every direction from the mines. In the opinion of some authorities the carbon for the diamond was supplied by these shales. The material of the neck, according to Prof. Carvill Lewis, is a dark-green heavy rock resembling a dense serpentine, in which one sees glistening plates of brown biotite, small deep-red garnets, large dark-green crystals or grains of olivine and bronzite, and a large number of angular fragments of altered black shale, so abundant as to give the rock a brecciated appearance. Olivine, he says, forms the most abundant constituent in the rock, placing it among the peridotites. There is also a large proportion of calcite, and among other constituents are pyroxene minerals, titanite iron, mica, apatite, talc, chalcodony, garnets and zeolites. In his second paper on the subject, read at the meeting of the British Association in 1887, Prof. Lewis said that explorations of the preceding few years had placed it beyond question that the serpentine rock called "blue ground" was in reality the matrix of the diamond. "Recent investigations," he wrote, "seem to place it beyond question that diamonds are as much a part of the Kimberly rocks as biotite, garnet, titanite and chromic iron and perovskite, and that, like these minerals, they may be considered as a rock ingredient. The fact that they continue just as abundant, if not more so, the deeper the mines are explored; that they are never found in, or especially associated with, the foreign inclusions of gneiss, granite or sandstone; that they are distributed abundantly through all parts of the rock; and that in each of the four principal mines the diamonds have distinctive features of color, lustre and shape, are, with the microscopical evidence of the eruptive character of the rock, strong reasons for holding that the diamonds now lie in their original matrix."¹

On the other hand Prof. Bonney, the Geologist of University College, London, and himself the editor of Prof. Lewis' papers, affirms in a paper read before the Royal Society last year that the blue ground is not the birthplace of the diamond, any more than of the olivine, garnets, pyroxenes and other minerals which it incorporates. A study of

¹ Papers and Notes on the Genesis and Matrix of the Diamond by the late Henry Carvill Lewis of Philadelphia, edited from his unpublished MSS. by Prof. T. G. Bonney, p. 44.

specimens of eclogite from the Newlands mines² has convinced him that the diamond is as much a constituent of that rock as zircon may be of granite or syenite. His position is that neither the diamond was formed by the action of molten rock on carbonaceous material, nor produced in place by the action of steam or hot water in a subsequent solfataric stage of the volcano, but that it was formed like the garnets and pyroxenes "in some deep-seated holocrystalline mass which had not been scattered by explosions." The constituents of the blue ground, Prof. Bonney says, are chiefly waterworn pebbles of crystalline and sedimentary rocks, and probably have been supplied from the conglomerate, which underlies the Kimberley or Karoo shales, and is supposed to be of Permian or Permian-carboniferous age. "If this deposit has supplied the boulders, the date of the genesis of the diamond is carried back at the very least to Palæozoic ages, and possibly to a still earlier era in the earth's history." This is as far as the English professor goes. He does not suggest that the diamond was always diamond, nor that it is anything else than pure crystallized carbon. And he does not gainsay the utility of volcanic force as an agency in the distribution of diamonds, even if, through the dynamics of heat and pressure, it had no lot or part in their genesis. It was the Kimberly volcanoes, or others like them, which brought to the earth's surface the diamonds first discovered in South Africa, in the lower valleys of the Vaal and Orange rivers.

Scientific theories are full of interest, especially when they are founded upon observed facts; but although diamonds are said to have been produced in the laboratories of two or three men, no eye has witnessed the operation of the process in the alembics of Nature. We can gather and collate data, however, and in the clear light of facts and conditions we may reason our way to sane, if not to positive conclusions. And having, as I think, built up a good working hypothesis, I come back to the question,

ARE THERE DIAMONDS IN ONTARIO?

It has been conclusively shown that there are diamonds in the glacial drift of Wisconsin, Michigan and Ohio, for they have been found there. It has been conclusively established, also, that during the ice age the materials of the drift were borne down into those States from the highlands of Ontario, for many of the stones, pebbles and gravels, constituting the drift are identical in composition and structure with varieties of ice-plain country rock which abound in regions northward of the Great Lakes. From Ungava territory east of Hudson bay and Keewatin territory west of it two great mantles of ice, moving south and southwest, shoved before them and carried with them all the disintegrated rocks, clays, sands, gravels and boulders of every size. Whatever was loose on the face of the earth, those ice sheets gathered up in their huge folds, to be broken and crushed and pulverized, and to be dumped off as one would unload a cart, scores or maybe hundreds of miles from the parent rock. The terminal moraine which marks the southerly limit of the ice field has been clearly traced across the States of New York, New Jersey, Pennsylvania, Ohio, Indiana and Wisconsin; but there are many moraines of recession whose positions are not so well known. One of the most important of these lies almost at our own door, known as the Oak Ridges in some sections of it, and in others as the Pine Ridges. It extends across the counties of York, Ontario, Durham and Northumberland, but our geologists have hardly looked at it yet. Mention is made of it here merely to point out that it is very largely composed of materials derived from the rocks nearest to it—from the Hudson River, Utica, Trenton and Black River formations. There are, of course, many fragments of crystalline rocks from the older formations, but as far as I have observed the great body of the moraine has been built up with the debris of local rocks. The moranic ridges around Rochester, in New York State, are composed largely of material from the Medina sandstones and

² At these mines in West Griqualand the workmen occasionally come across well rounded and boulder-like masses, some of which are a foot in diameter, of crystalline rock studded with garnets, and the specimens studied by Prof. Bonney were from these mines. One of them which contained a number of imbedded diamonds is described as a coarse grained rock, apparently composed of two green-colored minerals, one darker than the other (but possibly only different states of the same mineral) and of rich resin-pink colored garnets, varying in size from a hemp seed to a pea, with slightly irregular distribution. Putting aside the diamonds, the rock in its unaltered condition is a crystalline mixture of chrome-diopside and garnet, with a few small enclosures of olivine, being a variety of eclogite and of igneous origin. "Take away the alkali from a magma with the chemical composition of a diorite, and the result would be garnets and place of feldspar, i.e. an eclogite."

shales; and the terminal moraine in Pennsylvania consists chiefly of rock and earth, carried down from formations which outcrop either in the northern counties of that State or from southern and central New York. There are, of course, many boulders and pebbles of Archæan formations, and I do not doubt that a good percentage are of Canadian origin. I have noticed, indeed, that when an American geologist comes upon a boulder of granite, or gneiss, or quartzite, he calls it a "Canadian." The fact is obvious, however, that glacial drift is not in the mass borne very long distances; and it would require good evidence to sustain the opinion of Prof. Hobbs that the moraines of Ohio, Michigan and Wisconsin in which diamonds have been found are constructed out of materials carried upon ice or shoved forward by it a distance of 700 miles from the tableland of Ungava.³

We have not been looking for diamonds in Ontario, although Dr. Lawson and Dr. Coleman some time ago suggested the probability that they might be found in the Rainy Lake region. In his report on the geology of that region Dr. Lawson wrote: "The occurrence of bosses of serpentine suggests the possibility of diamonds, and some enterprising prospector may yet be rewarded for a close examination of the vicinity of the serpentine rocks indicated on the map, or of others that may be discovered, particularly if they be found near the carbonaceous schists that sometimes occur in the Keewatin."⁴

In these Keewatin rocks Dr. Lawson found evidence at several points of extinct volcanoes, one or two of which were of immense size. Dr. Coleman alluded to the matter in the Fourth Report of the Bureau of Mines, and in the Seventh Report he referred to the widespread occurrence of slates in the Keewatin, some of which have a graphitic look. He mentions one sample analyzed by Dr. Adams which gave 7.44 per cent. of carbon. But it will be said that these localities are too far west to supply drift material even for Wisconsin, as the direction of ice movement there was southwest. A locality in which conditions equally favorable are presented is the north shore of lake Superior, around Thunder cape, where there is a thickness of not less than 1,000 feet of Animikie slate, cut through by numerous dikes of diorite, with intrusive sheets of the same material which Lawson has shown to be laccolite sills. Logan counted thirteen of these dikes parallel to each other in a width of two miles, one of which has a thickness of 200 feet, and referring to the chert layers at Thunder bay in the report for 1846-7 he wrote: "Some of the chert bands appear to be made up of a multitude of minute, irregular, closely aggregated sub-globular forms, floating as it were in the siliceous matrix, and anthracite appears to be present in some of these, leading to the supposition that the color of the black chert, even where the sub-globular forms are not detected, may be owing to the presence of carbon." Another interesting fact is mentioned by Macfarlane, who found plumbago with copper, iron and magnetic pyrites on Pyritic island, and that frequently large patches of the veinstone of Silver Islet were impregnated with graphite.⁵

In conditions like these, where carbonaceous slates have been subjected to the influence of molten rock in the forms of dikes and sills under great pressure, I think we ought to look for diamonds and expect to find them. The likelihood is not less in a large dike than in a volcano neck, if one of the theories on the origin of diamonds is true; and we have been treated to too many surprises by new discoveries within the last ten years in Ontario to be deterred or dismayed by the man who says a diamond has never yet been found in a dike or a sill in a formation of carbonaceous slate. But there are numerous other localities in northern Ontario besides the region of Thunder Cape, where in like circumstances diamonds might possibly occur. I mention only one, the township of Balfour near Sudbury, where a vein of anthracitic carbon was discovered four years ago in a formation of fissile slate. Analyses made by Dr. Ellis showed the vein matter to give 7.42 per cent. of fixed carbon and the slate 6.8 per cent. Samples of slate from the same region recently analysed gave as high as 13 per cent. of carbon.

³ Owing to their extreme hardness diamonds would be affected in very slight degree by wear and tear of glacial action; but as the ice was constantly losing part of its load, especially upon the southern slope of ranges of rocks, it is hardly conceivable that stones the size of diamonds would be carried the long distance of 700 miles.

⁴ Report on the Geology of the Rainy Lake Region, by Andrew C. Lawson, p. 180 F. Geo. Sur. Report, 1887.

⁵ The Canadian Naturalist, vol. iv, New Series, pp. 461-463.

NIVEN'S BASE LINE, 1899

By William A. Parks

The 120th mile post of the Nipissing-Algoma boundary is situated some distance north of the height of land, in the vicinity of Night Hawk lake. In the summer of 1899, Alexander Niven, O. L. S., was despatched under the authority of the Commissioner of Crown Lands to run a base line from this point due west, a distance of about 120 miles, to Missanabie lake. Under instructions from Archibald Blue, Director of the Bureau of Mines, I accompanied this survey to report on the geological and topographical features of the region, as well as its soil, timber, water powers, drainage and various minor features. By taking advantage of the numerous water courses, crossing the country north and south, a considerable area was explored, and by following the Indian canoe routes between the rivers valuable geographical knowledge was obtained. In view of the very incorrect maps now existing, a more accurate description of these cross routes should prove of great value.

Accompanied by Mr. H. S. Michie of Fergus, who acted as my assistant during the summer, the party arrived at Matagama Station on the C. P. R., early in the morning of the 6th day of June. From this point we proceeded by an excellent canoe route to Fort Mattagami, and thence to our starting point, the 120th mile post on the Nipissing-Algoma boundary. A description of the territory traversed by this route will form the first division of the report proper.

The line ended a short distance west of Missanabie lake, and I was able to report in Toronto on Sept. 21. On the map accompanying this description I am able to vouch for the accuracy of the plans described in the text; some other routes are shown, which I believe to be substantially correct, but which I have not been able to verify by personal observation.

ROUTE TO FORT MATTAGAMI.

The canoe route leaves the railway a short distance east of Matagama station, on the south side of the track. It is represented by a small creek, about ten feet wide, flowing approximately parallel to the railway, in a northwest direction, and expanding in places into shallow marshes. This stream crosses to the north of the line, about a mile west of Matagama, and passes into the Spanish river. At this point are seen Laurentian outcrops, represented by pink and gray granites with included fragments, the whole fading imperceptibly into gneiss. One half mile up the Spanish river is a small rapid over gneiss, with a short portage on the easterly side. A mile above is a small rapid, requiring no portage. On proceeding a short distance above this point a lake-like expansion is seen, with a waterfall visible straight ahead. The route, however, does not follow the river in this direction, which leads to Biscotasing, but turns off to the right, and at a distance of three or four miles down stream arrives at a gorge in pink granite, passed by a short portage on the east side. Twenty chains lower occurs a heavy fall, with a somewhat longer portage on the right hand side. Below the portage we cross the river, and keeping the left shore again start up stream. This alternation of up and down stream is at first very confusing, and almost inexplicable. It is owing to the existence of a large island in the Spanish river, and to the fact that this stream is composed of two branches.

On both sides of the river below the last mentioned portage an interesting series of Laurentian rocks is exposed. First is seen a highly hornblende granite with numerous veins and concretions, followed by undoubted gneiss which is capped by a fine pink eruptive, almost destitute of any ferro-magnesian constituent. A similar eruptive occurs on the left side of the river, rising into hills of some height; it is much mixed with gneiss, and shows many varieties, varying from a binary granite to a coarse highly hornblende example of the same rock.

From Matagami to this point the usual timber of this northern country has been in evidence; chiefly spruce, poplar, birch and tamarac. Here however, and for some distance to the north, areas of pine occur, and large stretches indicate having once been covered with that timber, though now presenting only scrub and fire-swept forests.

After turning to the left around the point below the last portage, we ascend a river-like stretch with a couple of rapids, after which for 25 miles we follow a series of narrow lakes, in a direction almost due north. The upper Spanish river pine area may be said to more or less continuously surround these lakes. Some timber has been cut on these ranges, but I am told that the venture did not prove a financial success. As far as I was able to observe, both here and at other points in the region, the timber is undersize, a two-foot tree being the maximum, with the average considerably lower.

The rock throughout this stretch is gneiss, in places very granitic; the scenery on the whole is bold, hills of 100 to 200 feet being frequently visible from the water. The soil is scanty and mostly represented by sand. From the last of this series of lakes the route follows a small and very swift creek for about two miles to a lake of a mile in length, also due north. Here we cross a 10 chain portage 20° w. of N. to a little lake of beautifully clear water, indicating our proximity to the height of land. The rock on both creek and lake is chiefly gneiss, but exposures of porphyritic granite are seen, as well as a dike of diorite, 100 yards wide, striking E. and W., and crossing the creek valley near its upper end.

The last mentioned lake as well as the one below it ushers us into an area of burnt sandy territory, which continues, with some interruptions, a long distance to the north and west. A little to the left of the end of the last portage on the small clear-water lake, another canoe route connects with this one; this route leads to Biscotasing, and is generally used by Indians travelling light; but, as it necessitates some long portages, it is not suitable for heavy freighting. After crossing this lake, we make another 20-chain portage into a lake about a mile long, from the extreme northern end of which a portage two miles in length, 30° E. of N., brings us to Kapismapenaceke lake. This portage traverses coarse sand and gravel, all burnt, but young pitch pine bid fair to again clothe the region in green.

Some exposures of gray and pink porphyritic gneiss are seen on this portage; the average strike points to a general east and west arrangement of the rocks. In the vicinity of Kapismapenaceke lake, outcrops of rock are not frequent, the surface consisting exclusively of coarse sand and gravel, from which the old forest has been entirely removed by fire; some few red pine on the islands point to the previous condition of the country. From the northern end of this lake a route leads to Mesumekenda lake and thence to Kenogaming. The trail to Mattagami turns off to the right as shown on the map, and descends a small creek with some rapids to Muskegogama lake (Swampy lake).

Just before entering the lake a belt of rocks is encountered, striking N. 30° W., and presenting examples of diorite and diorite schists.

Muskegogama lake is in all about five miles long, and is for the most part surrounded by green bush. The river out bears the same name, and is interrupted a short distance down by a fairly heavy rapid, making necessary a short portage (3 chains) on the right hand side. The rock here is diorite. Twenty chains more of river brings us to another rapids and a ten-chain portage, also on the easterly side. The rock here may be either granite or gneiss, and is crossed N.E. and S.W. by veins of a fine grained eruptive, probably diabase. From here to the next portage is about two miles, the lower part of which is swampy, while the upper part shows granite and gneiss crossed by numerous dikes of diorite. This portage is made to avoid a long series of rapids, and is about one and three-quarters of a mile in length, over sandy soil well covered with small timber, pitch pine predominating. This trail enters at the southern end of Minniesinaqua lake (Wooded Islands). We follow this lake for 25 or 30 miles, making a turn at right angles about half way down. It has green shores for the most part, but only an occasional pine. On entering the lake we encounter a dark green massive diorite, which soon gives place to various Huronian schists, which alternate with granites and other rocks, all much contorted and altered. True pink gneiss occurs at the point where the lake turns to the east, and although gneiss occurs in places on the south arm, Huronian schists and diorites, together with more or less crushed granites and felsites, form the main country rocks. A short description of these rocks follows:—

Diorites: Dark and light green, the latter entirely altered under the microscope, showing little but kaolin and a fibrous indistinct derivative of hornblende.

Schists: Light gray and olive colored rather hard examples, showing little but fine quartz under the instrument. Also a dark green white spotted variety.

Granites: Pink and red, more or less crushed, showing strained quartz, altered orthoclase, and with the original mica converted into magnetite and indistinct products.

Felsites: Fine grained, and weathering quite white.

Passing down the Minniesinqua river we run a small rapid, and two miles below another. Just beyond this we make a 60 ch. portage on the east side, over gneiss and sand (Fishing rapid portage). Below the portage is some rough water to run, and almost immediately we enter the Mattagami river, or, as it called by the Indians, Nā pow-quā-zī river.

From the junction of the two streams to Fort Mattagami is about five miles, the latter half of which is lake. Green shores are continuous, and the soil deep, only a few exposures of gneiss being seen. The post is beautifully situated on the point dividing the two southern arms of the lake. This is an old and important location of the Hudson's Bay Co., and although the present buildings are comparatively new the post has been in existence for 200 years.

To the east of the post a long bay of 10 miles stretches almost due south. Its shores for the most part are rocky and well timbered, but no pine is seen. The northern end presents exposures of gneiss and bands of mica schist and felsite, while to the south a more granitic aspect is apparent in the rocks. Towards the extreme south end the granite becomes very coarse and porphyritic, and is followed on the easterly side by gray and green spotted micaceous schists; also sericitic schists mixed with granite and felsite. Below these exposures are bands of intensely crushed and sheared granites, followed by a high hill presenting Huronian schists and a pronounced volcanic conglomerate, with bombs of granite varying from two feet in diameter to microscopic dimensions. All these rocks strike nearly east and west. From the peak of the bay a mile and a half portage over a sandy and hilly country brings us to a small lake of clear water, forming the first step on the route to Nā pow-quā zī lake and river. On the east side of the bay, about half way from the post, a stream enters in a narrow inlet. This is the head of an old canoe route to Matachewan, and thence to Temiscaming; owing to extensive windfalls in the spring of 1899 this route has been rendered practically impassable. Indians now making the journey go by the Gull lake, or winter road.

The northern branch of Mattagami lake is about 20 miles long, and seldom exceeds a half mile in width, while the average is even less than that. Many high rocky hills approach the shore line; these bluffs are composed of granite or gneiss, perhaps both, insensibly merging into each other. No other rocks were seen on the stretch.

Kenogamissee portage, of a half mile on the west side, connects this lake with Kenogamissee lake (Long lake), which stretches 25 miles to the north and is in nearly all respects similar to Mattagami lake. The rocks, however, show a little more variety. At the portage the water rushes over a bed of gneiss, but a dike of diorite runs along the west shore; another such dike infringes on the lake, about six miles down, and is perhaps accountable for the narrows at that point. Six miles below this we find crushed granite and mica and hornblende schists, with fine pink granite and felsite. These rocks are followed to the north by soft Huronian mica schists striking $\approx 10^\circ$ N., and dipping 30° from the vertical to the northwest. This narrow belt is not continuous, but gives place to the usual granitic gneiss, which however is occasionally interrupted by intrusive granites and greenstones to the foot of the lake.

The Mattagami river breaks out of the foot of Kenogamissee lake through a gorge in which the water is extremely rough, rendering necessary a mile portage on the east side. On this trail are seen soft schists with quartz, striking N.W. and S.E., and dipping almost vertically. Below the portage the traveller is advised to cross immediately to the west side, and run fairly close to that shore into the bay below. In this bay a strong eddy runs up the east side, whence the name of the rapids and portage, Wawiatan (Eddy).

On the shores of both these long lakes some few pines, both red and white, were noted, where the country had not been burned, but I doubt if the size of the timber or its abundance would ever warrant a camp for its removal.

Pine may be said to be practically absent from the country north of the Wawiatan portage. For seven or eight miles the river proceeds with rather a stiff current to the Omeemee (Pigeon) rapids. Here a portage is required only in very low water; in high water nothing but a strong current is observed. On this stretch we pass the mouths of two considerable streams, the Grassy river on the right and almost opposite the Ta-ta-

ti-chap-i-ka. The shores of the Grassy show continuous sands hills as far as observed. The current is very swift, and but few portages are required to reach Peter Long's lake. The lower four or five miles of the Tatatichapika river are almost continuous rapids; to avoid these a portage above the Wawiatan rapids connects the river with Kenogamissee lake. This portage forms the head of a route to Kenogaming and the Ground Hog river. For the plan of this route as shown on the map I am indebted to Mr. Jos. Moore of Fort Mattagami. This river drains Great Pike, Misquamabie (Red Sucker) and Tatatichapika lakes. Owing to a thick covering of sand exposures of rock are not frequent on the river; where seen, however, they indicate a continuous Huronian area. At the Pigeon rapids hard schists of a light olive green color are mixed with some softer kinds, containing quartz, an assay of which resulted in a strong trace of gold, possibly two dollars per ton.

The line at 16 m. 20 ch. crosses the Mattagami four or five miles below mee rapids. Some distance above the line at a point where the river curves to the west, a portage leads into Water-hen lake. This trail ascends a river bank of some height, and then follows a level sandy country with small pitch pine to the lake. Around and beyond this lake the country is low and somewhat swampy. The line passes close to the northern end of the lake, and at about this point leaves the larger spruce and poplar timber, and enters an area of tamarack and spruce scrub. Expeditions in various directions revealed an essentially similar country, with burnt areas and windfall for some distance.

From the line to Southeast Bend brook is three or four miles. Just below this stream is the head of the first portage to Night Hawk lake, which will be described later. Below this point the river continues north for four miles, and then turns sharp to the west for about five miles, bringing us to a series of heavy rapids. The traveller should keep the west shore and run into a creek entering just above the rapids; here a 15 ch. portage enables him to pass. A small island breaks this rapid, and it may be run to the left of the island in light canoes. A mile of swift water brings us to the second portage, also on the west side and about 15 ch. long. Care is required below this portage, as there is some bad water to run near the west shore. It is advisable to keep well out on nearing the end of an island seen in the river, and then cross to the east side below it; here will be found the third and last portage, the sandy portage proper, known to the Indians as Kiskeqtamo. The series of rocks presented at these rapids is as follows: Hard gray schists at first portage. Below, a coarse gray, somewhat schistose rock, composed of quartz, feldspar and pearly mica, apparently an altered quartz diorite or porphyrite. At the top of the second portage: Hard schists and some softer varieties with streaks of quartz, all striking N. 60° W. At the foot of the portage a dike of massive green diorite strikes N. 20° W.

At the last portage we find fine grained gray quartz schists, with some pyrite and streaks of quartz; an assay from here gave traces of gold.

On all three portages the soil is sand, but below we commence to encounter the clay belt. Some small clay areas have already been seen, but clay now begins for the first time to constitute the main soil. It is interrupted by some sand at various places as far as the Kamiskotaia Sagaian river, where it seems to become continuous. Below this stream the Mattagami is about four chains wide, with gentle current for ten or twelve miles, beyond which it was not explored. The shores here are continuously low, and show clay soil with poplar, birch and spruce, and only occasional exposures of Huronian schists and massive diorites.

ROUTE TO KAMISKOTAIA LAKE.

The Kamiskotaia river enters the Mattagami on the west side, about six miles below the three sandy portages. It is about 40 ft. wide at its mouth, but its navigability is interrupted by rapids. Only a short distance up we portage on the south side, and just beyond are forced to carry on the north side to avoid a heavy fall. A half mile above this fall is another rapid; just below it we enter a creek on the south side, and make a 60 ch. portage to another stream, also a tributary of this river. On this portage occurs a peculiar hard schistose rock, striking a little south of east. It presents various shades of pink and green, and weathers out with white dots, owing to a decomposed feldspar



44. Indian Children at Fort Mattagami, p. 125.



45. Three Generations at Fort Mattagami, p. 125



16. Canoeing near Height of Land in Algoma District.



47. Packing Supplies in Northern Algoma

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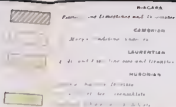
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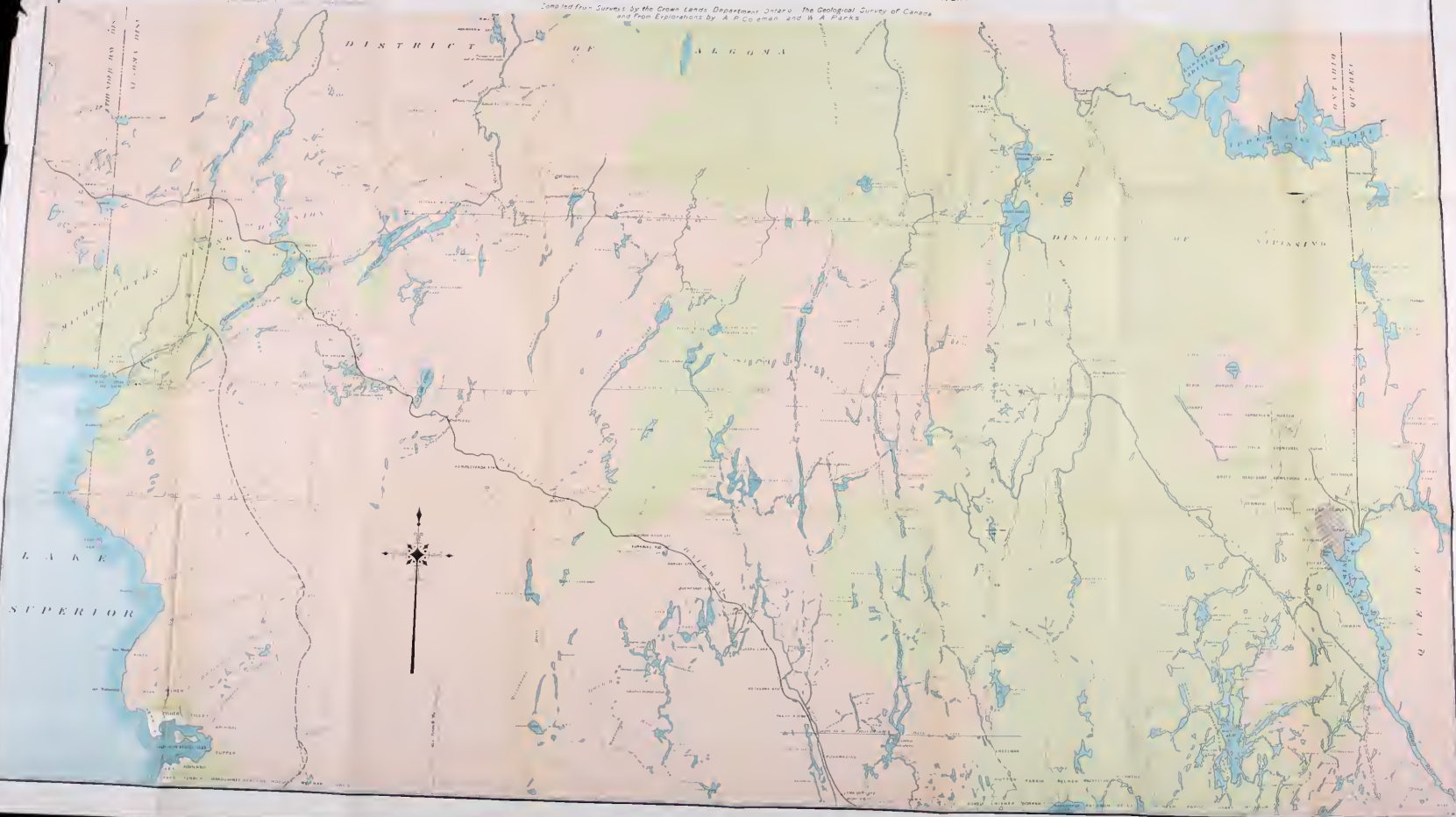


Map of Parts of THE DISTRICTS OF ALGOMA & NIPISSING, SHOWING THE UPPER BASINS OF THE MOOSE, OTTAWA AND MICHIGICOTON RIVERS.

Scale 8 Miles-Inch

Printed by the
Government of Canada
1900

Compiled from Surveys by the Crown Lands Department, Ontario, The Geological Survey of Canada
and from Explorations by A. P. Coleman and W. A. Parks



Microscopically it shows a very fine grained structure, and consists principally of quartz and a fine turbid decomposed ingredient. This rock runs up into a hill of considerable height, from the summit of which several such conical hills are visible, particularly to the north and west, giving a characteristic appearance to this region. From the end of this portage, we ascend the creek through a low and swampy country for about a mile and a half, and make a portage about north to a second stream which flows out of Kamiskotaia lake. On this stream are seen massive green diorites and fine grained gray and green schists, the latter probably altered diorites.

Kamiskotaia lake is a fine body of water of from two to three miles in diameter, and containing several rocky islands. The rock at the head of the river is a hard massive green to black rock, resembling diorite, but it contains a large amount of quartz. Under the microscope it shows decomposed plagioclase crystals and blebs of quartz, all imbedded in a fine grained matrix, consisting largely of quartz with minute grains of a dark alteration product. It is probably an altered quartz diorite.

ROUTE TO NIGHT HAWK LAKE.

The first portage to Night Hawk lake leaves the Mattagami river, as above indicated near the Southeast Bend brook; it runs due east about one and three-quarter miles. After ascending a slight elevation, the trail leads through a rather wet country, well timbered with good sized spruce and poplar. For about a mile it then mounts a little higher, and continues for the rest of its length over dry sandy soil, with pitch pine. A very small lake succeeds, and then a short portage north to a larger lake about one and a half miles in length. This lake presents some bold bluffs on the easterly side, mostly diorites, with cubes of pyrite and streaks of quartz, but on the westerly shore fine gray schists with pyrite and soft whitish examples, all striking N.E. and S.W. The route does not lead through the lake, but follows the east shore around a point and a small island to the next portage of 20 ch. S.E. The next lake is shallow, and rock outcrops occur only at the eastern end near the portage, which is one and three-quarter miles long, about east and very rough. Fairly heavy timber occurs here, poplar and spruce and some cedar of good size.

From west to east the following series of rocks is presented: A soft schist, weathering rusty, fine and resembling quartzite across the planes, but pearly on the partings.

A green and purple schist, the matrix so fine grained as to resist any resolution into constituents, spotted with white porphyritic dots of decomposed feldspar. Light green altered diorite and diorite schists. Soft and rusty schists, as at western end. Quartz occurs at various places, an assay showed decided traces of gold.

The portage ends on a small and crooked creek, crossed by several old beaver dams. We descend this stream a mile and a half, and make a two miles portage into Porcupine lake. Some rock occurs on this trail, and it is worthy of note that we here enter the clay area of Night Hawk lake.

Porcupine lake has already been described in the Report of the Bureau of Mines for 1898. Access to Night Hawk lake may be effected either by the two portages indicated or by the river, which is easily navigable, only one short portage being required to pass a permanent log jam.

The line, starting from the 120th post on the boundary, continues for only a short distance in the clay area of Night Hawk lake. It then enters a rough hilly and rocky country.

This region of Huronian outcrop is first met at two and a quarter miles, and continues with some interruptions to about the sixth mile post. Although a little clay was seen, fine white sand is the prevailing soil west of the rough country.

Several expeditions were made through this region, and an interesting series of rocks discovered.

The more southerly aspect of the ridge consists of a fine grained, somewhat crushed, granite, bounded on the north by sericitic schists, striking N. 10° E. This is followed by a peculiar streaked, fine grained quartzite rock for ten chains. This rock is well mineralized, and several assays showed varying traces of gold.

To the north of this is more of the soft sericitic schists, followed by hard gray schists. This series is repeated in practically the same order by a second ridge north of the former one.

Two miles farther west a cross-cut of this country showed at the north a soft weathering sericitic schist, followed by massive diorite. Beyond this occurs a felspathic schist, with pearly mica, containing streaks of quartzite and weathering very ferruginous. This is followed by alternating bands of quartz and quartzite, yielding as high as one dollar per ton of gold on assay.

Sixty chains from the lake a second ridge of pink quartzite is seen to contain bands of true quartz. Towards its south flank this belt becomes very ferruginous, with crystals of both hematite and magnetite.

The last rock seen was a succession of soft and hard schists, all striking east and west and dipping north at a high angle.

This region is certainly worth thorough prospecting.

On the south bay of Night Hawk lake only a few exposures of Huronian schists and diorites are visible. Passing south in the vicinity of the old boundary line, on Starvation creek, heavy clay soil and luxuriant vegetation were encountered. This creek is said to form part of a route to the Grassy river, passing close to Mt. Sinclair. Owing to almost continuous jams of driftwood it was found impossible to navigate the stream, and the attempt to explore the Grassy river had to be abandoned.

There are several canoe routes between the Mattagami and Ground Hog rivers. One by way of Opishingquaquaya and Wawayeshatching lakes is shown on the map. This was sketched from information obtained at Fort Mattagami. The best used road, however, is that about to be described. It starts in the southwest angle of Minniesinaqua lake, from which point a choice of two routes is offered for a short distance. Close to the high rocks a small creek enters the lake, which may be ascended to a little pond, above which two half mile portages bring us to Windegoaquinz (Cannibal) lake, which discharges at its northern end into the same river, which enters Minniesinaqua lake close to the north of the creek.

This stream is about a chain wide, and varies much in depth. On the whole, the current is swift and the water clear. The country consists entirely of sand, as shown by the sand and shingle in the river bed. The timber shows some fair sized spruce and a few red pine, while poplar and birch are common as elsewhere.

Three portages are necessary, one about a mile up past a log jam, and two others at the upper end, near Windegoaquinz lake. From this point the stream holds in a west and southwest direction for about three miles to Macaming (Sore) lake. The only rocks seen on the river were granite and gneiss of Laurentian age, and the same rocks crop out on Macaming lake, rising into high hills at the southern extremity of the lake. The route lies straight through the lake in a southwest direction for over three miles. The river enters at the end over a ridge of gneiss six or seven feet high. There is a portage of ten chains on the easterly side. Twenty chains above is another rapid, and a short portage on the westerly side over granite. Considerable pitch pine occurs here, and continues to Mesumekenda or Great Beaver lake. On this lake, which is of considerable size, outcrops of granite and gneiss are common. The green bush, almost continuous from Minniesinaqua lake, here begins to give place to an extensive burnt tract.

Through this lake lies the route to Kenogaming, as already indicated. The portages as shown on the map are about correct in sequence, but it is very likely that their position is incorrect as well as the outline and bearing of the lakes. This chain of lakes is copied from old maps, with some corrections. From information obtained from Indians, these lakes are very much larger than indicated, and therefore the route must be much more crooked in order to allow larger lakes in the same distance. A reliable man gives the route from Mesumekenda to Kenogaming thus:

Creek—lake, five miles—creek—lake, six miles, Ka-na-ma-co-sen ce-ha—two short portages—lake, twelve miles, Ka sas-way-way-che-wung—creek with two portages—lake, 15 miles long (E & W) route crosses it. Atekepemeska—portage—lake, one mile—portage—lake, 60 ch.—portage, 40 ch.—lake, two miles—portage, mile and a half—Kenogaming lake. The same Indian informed me that around Atekepemeska lake, was a fine belt of large red pine twenty miles by six in extent.

The portage out of Mesumekenda is at the end of a bay opposite the entrance. On this bay are seen examples of very coarse granite, traversed by bands of hard barren quartz. The portage crosses similar rock for about 30 ch., all burnt and the trail hard to follow.

The shores of the next lake, Kapemichekama (Cross) lake, are almost destitute of green timber. The route lies straight across, and then ascends a small stream, with a rapid to a little lake. Across this lake we enter the creek again, and make a short portage on the right-hand side to Shangemequagama (Sandy Beach) lake.

As indicated in its name, this body of water is surrounded by sand; the country is much lower, with black spruce scrub, and the water has the white appearance seen near the watersheds.

Passing through this lake we enter the creek again, ascend a rapid, and traverse a small lake to a second stretch of creek, with three small rapids, showing red hornblende granite.

This brings us to Machegamiching, or Little Branch lake, showing marshy shores at first, but high hills of gneiss at the southerly end. A half mile portage over rough burnt sand, filled with boulders, leads out of this lake to the next, but it is so badly blocked that preference is given to the river, which necessitates four short portages.

Matastagan (After Cross Land) lake is decidedly marshy, and is constricted in the middle, where an easy rapid occurs.

The portage out of this lake is very hard to find, in fact no clear trail exists. It is advisable to keep the west shore, after passing the small rapid above mentioned, and after passing a marshy stretch, run in through the reeds, south of the point bounding the marsh on the north. Here we portage 25 ch. N. W. over semi-burnt country, to a marsh and creek, which after making another portage over sand and boulders brings us to a small lake, the head of the Mattagami waters.

A two-mile portage over barren burnt sand with boulders and bare Laurentian gneiss gives access to Rice lake, called in Indian Kanagushka or Itch lake, probably on account of the irritating effect of the rice husks.

Rice lake may also be reached by following up the river from Matastagan on which are six short portages, to a lake with rocky barren shores. A short portage out of this lake leads to a fine sheet of water, Pebonishewening (Winter Staying Place).

This lake is five miles long by three in width, and is entirely surrounded by burnt country, except the northern end, which enters a green belt of some permanence. An expedition north revealed a somewhat rough country, wet in places, but clothed with large spruce and poplar in ferruginous sandy soil. A portage out of this lake near its northern end leads into a small lake, which enters Rice lake by a creek at its northern end.

The first described route is the one usually travelled, and the route through Rice lake is best understood from the map. All the northern part of Rice lake is green, and the rock gneiss and hornblende schist with pink felsites.

The river out of Rice lake is a chain wide, and contains a considerable volume of water. The navigation is as below:—

One mile, rapid.

Sixty chains, rapid.

One mile, rapid, and portage on north.

Half mile, rapid, and portage on north.

One mile, rapids.

Half mile, lake.

On this stream are seen outcrops of granite with inclusions of dark hornblende schist, the whole much resembling an igneous breccia. Burnt areas again occur towards the mouth of the river, where it enters Sagetowwashka lake through a marsh, whence the name meaning "River coming out among Rushes." On entering the lake a long point will be seen on the opposite shore, about a mile distant. The course lies to the south of this, where we enter a deep bay, from the end of which the river rushes out by a series of heavy falls. On the easterly shore of this lake massive green diorites were observed, while the western side shows red hornblende granite, soft white schists and green schists of a harder nature. It is evident that a contact with Huronian rocks occurs here, and that the first indication of the change was seen on the river above.

Sagetowwashka lake also forms part of the direct route from Biscotasing, to Flying Post. For the map connecting this point with the railway I am indebted to Messrs. De Morest and Silvester of Sudbury.

Between Sagetowwashka and Matagaming lakes there is a fall of about 150 ft. in all, which is effected by eight rapids or falls, six of which require a portage. The first leaves a small bay south of the head of the river and passes the first series, where the river falls 50 ft. over dark green and mottled schists. A mile and a half below is the second portage, on the left side and about five chains long. The river falls ten ft. over dark green schists splashed with quartz. A mile below this portage the Woman river enters on the south side, and another half mile brings us to the third portage, also on the same side, and passing a fall of ten feet over syenitic rocks, green schists with pyrite and crushed granite.

A quarter of a mile of calm water leads to a rapid which is easily run, and the same distance below it is a series of falls where the river drops 40 ft., and a portage of 25 ch. is provided on the north side. The rocks are various kinds of Huronian schists. I noticed here some evidence of the presence of prospectors, but I saw no rock of a very propitious appearance. Twenty chains down is a rapid to be run, and a half mile lower a succession of falls, making a descent of fully fifty feet. This obstruction is passed by two portages on the southerly side, the first of 10 ch. into a small creek, and the second of 20 ch. out of it into the head of Matagaming lake. All along this stream the country is very rough and is covered by an old *brulé*, grown up with young poplar; the soil is sand throughout, and at the last two portages rises into hills of considerable height. Magnificent locations for water power are afforded by the heavy descents in short distances. The rocks, as already stated, consist of various Huronian schists, all striking east and west and dipping at high angles.

For about seven miles Matagaming lake is narrow and river-like, traversing an exceedingly rough Huronian area of high barren hills, consisting of various schists traversed by and interlaminated with some large belts of coarse, almost porphyritic hornblende granite. Towards the lower part of this stretch sandy hills soften the extreme ruggedness of the scenery, and bear signs of having been once clothed with white and red pine. The burnt barren condition of the country would afford every facility for systematic prospecting, and the general appearance of the rocks is not unfavorable, as the contacts of the granite masses are quite likely to prove auriferous. I regret that the necessity of connecting with Mr. Niven on the Ground Hog river rendered it impossible to make overland trips at this point.

A short distance beyond where the lake begins to widen, the big Northeast bay enters through a narrow channel. In this vicinity are hard gray dioritic schists and light green varieties, while soft sericitic schists crop out on the east shore about a mile below. From here to the end of the lake is about four miles. The river does not flow out at the extreme end, but at the west side about half a mile from the end. Hard schists are the characteristic rocks at this end of the lake, all striking east and west and dipping 70° to the north. The lake at this end is well timbered, with the exception of some burnt areas on the easterly shore. The river flows N. 30° E. about three miles and averages three chains in width. The current is gentle, but gives place to a strong rapid, easily run, however, just where the river enters Ground Hog lake. It is covered by a recent *brulé*, said to have originated near Chapleau, which again approaches the river below Ground Hog lake. Immediately on entering the lake, we approach Flying Post, an important station of the H. B. Co., in charge of Mr. McLeod.

Rock exposures are not common on the lake, but soft friable schists striking east and west occur a mile down the river. Three and a-half miles down is the head of the canoe route to the Pishkanogama river, and less than a mile below is a heavy rapid which can be run by experienced men. Below, the river turns sharp to the east, and on straightening out to the north plunges down a still worse rapid, Kaskemene Pow-wa-tic. The rocks here are soft white schists, which would make excellent whetstones. For five miles the current is fair, and the stream then passes through a narrow gorge in green diorite, and just below falls 10 or 12 ft., Me-ke-se wa sun rapids. A portage of five chains is necessary on the west side. At the foot of this portage six different schists are visible, as well as the dike of diorite to the existence of which the rapids may be due.

About two miles down very hard schists with pyrite, as well as massive green diorite, occur at another rapid to be run, at the foot of which a 25 ch. portage on the west side is necessary to pass the Ostandigistagan falls. A massive diorite, N. 20° W., occurs here at the foot of the portage; above, the rocks are Laurentian. I believe the actual

contact to occur above both these rapids. A mile further is nearly half a mile of heavy rapids, which can be run by large canoes only; a portage exists on the west side. A mile and a-half more brings us to Sa-ha-wa-che-wun rapids. This also can be run, but for small canoes a portage is necessary on the west side.

A course of two miles, after passing the mouth of a large stream, the Sturgeon river, brings us to the Kikenda Onegum (Kettle Portage), which is 25 ch. long, and on the east side. Ka-sing-ge-ke-che-wun (Young Pine) rapids, with a portage of ten chains on the west, occurs two miles below the Kettle Portage, and is succeeded, at a distance of a mile and a half, by the Ka-gas-te-wa-tang-ga sing rapid, with a short portage over a sandy hill on the east side. Three miles of clear navigation through a somewhat lower country brings the voyageur to the Wa-be-gash-ic rapid, which can be run. A little more than two miles leads to a small grassy island on the east side, where the line crosses at 44 miles and 51 chains. Just below the line is the Chick-a-wab-skung rapids.

From these remarks on the navigation of the Ground Hog river it will be seen that it is very difficult and dangerous. Below the line it is said to be still worse, with long heavy rapids. These considerations deterred me from attempting any further exploration with my small canoe. No one should make the trip down this river without the services of a first-class canoe man, and one well acquainted with the region.

Two miles east of the river the line crosses Wa-wa-yes-kat ching lake. The country between is low and wet, with windfall and brûlé. A portage connects the lake and river a short distance south of the line. The lake shores are mostly low, and consist of clay, which continues ten miles to the east.

The whole region to Mattagami river is low and level, with only occasional rock exposures. Mr. Niven reports the last Huronian rock to the east of the Kamiskotia river at 27½ miles.

While ascending the Ground Hog river on July 24 numerous fragments of wood and floating debris indicated a storm to the south, and on arriving at Flying Post Mr. McLeod informed me that a heavy thunder storm from the w.s.w. struck the Post and was of sufficient violence to dislodge logs in the buildings and to lift his large freight canoes bodily into the air.

A direct route to Pishkanogama lake leaves the Ground Hog in the bend below the lake, but as it involves three long portages, as well as others, it is used as a winter route only.

The trail followed leaves the river, as indicated previously, at a point about seven miles below the post. The route is given below in the form of brief notes.

Portage: N.W., 50 ch., sand, small pitch pine.

Lake: 15 ch., north.

Portage: N., 40 ch., sand and gravel, spruce.

Lake: N.W., 30 ch.

Portage: W. 10° N., 1½ miles, first part level and sandy, second part hilly with sand and boulders. exposures of bright green schists.

Lake: 12 ch. W. 20° N., narrows, 20 ch. W. 40° N.

Creek: 20 ch.

Portage: North side, five chains, green Huronian schists, with sugar quartz, striking E. and W.

Lake: Course along south shore about one mile. Contains several islands of white mica granite or gneiss.

Creek: 10 ch., Laurentian boulders.

Portage: 20 ch., W. 10° N.

Lake: S. 10° W., 60 ch. to narrows. Course along west shore to creek. On this lake are seen gray quartz schists, fine gray gneiss, green schists resembling protovermiculite schists, friable white hydromica schists, and brown ferruginous examples with pyrite and copper pyrites, an assay of which gave no gold. The average strike is N.E. by S.W. and the dip variable. The soil is sand, with some clay, and would make a good light agricultural soil.

River: N. 30° W., 1½ miles, very crooked and swampy.

Lake: Course 1½ miles into northwest corner of lake. Some small red and white pine. Rocks:—various schists, hard gray kinds with pyrite, soft white and white-weathering examples, and green hydromica schists with pyrite, als

massive green diorite and diorite schist with pyrite. Under the microscope the darker of these schists shows a fine quartz and feldspar matrix, with much altered hornblende in larger crystals.

Portage: 10 miles, w. 20° N. First part low wet windfall; second half green with poplar, dry soil, largely sand.

Lake: Small, marshy.

Portage: Half mile, dry, hard, schistose and massive gray rocks, probably altered diorites.

River: About five miles to Pishkanogama river, several rapids, two portages, both on south side, the first about a third of a mile and the second a little more than a half mile. Soil is fine white sand; timber improves as we approach the river.

This stream is known as the Muskego, or Swampy river, and the name is well deserved, for above the portage it flows out of a low swampy lake, with peat bogs and small black spruce scrub. The same character obtains for some miles up the river above this lake. This country more resembles the low lying peat bogs of James bay than any other seen this summer.

PISHKANOGAMA LAKE AND RIVER.

Pishkanogama lake may be reached by a fairly good canoe route from Ridout station on the O. P. R. This route, as shown on the map, is from an Indian's sketch, and I think is substantially correct. The lake itself is about 25 miles long, the last 10 miles being narrow and surrounded with high gneiss hills, particularly on the eastern side. The rocks show many minor variations, and contain many belts of coarse red binary granite, particularly near the northern end of this narrow southern arm. At a second narrows, about four miles from the northern end of the lake, a belt of Huronian rocks crosses the course, striking a little to the south of west and dipping 75° to the northward. This belt consists of diorite and diorite schists, and talcose foliated green schists, with sugary, barren quartz. Two other belts of diorite, much mixed and contorted, also cross the lake at the points indicated on the map. The soil in this region is sand, and the timber of fair size; considerable pine exists on the northern and eastern shores, the largest and most continuous grove seen this summer. The whole district shows evidence of having once been covered with this timber. The presence of these pine groves, and some beautiful and extensive sand beaches at the northern end, with an open pitch pine region inland render this lake highly desirable as a summer resort, but of course the difficulty of access renders its use for this purpose impossible at present. Near the head of the river at the north end there are several Indian houses and a winter outpost of the Hudson's Bay Co.

The route does not follow the river, but a portage is made from the sand beach about a mile to the east. This trail is a mile and a half long, a little east of north, over sand with pitch pine and some fair red pine. From this portage to the Swampy river is about five miles. Below the portage are some green schists, followed by 20 ch. of rapids to run, and then a small fall with a portage of three chains on the east side. The rock here is gneiss, but below dark gray schists and streaked white and green examples occur at several points above the Swampy river; most of these seem to strike northwest and dip at a high angle to the southwest.

A half mile below the Swampy we run a rapid over boulders, or portage on the west side. Another mile and a half brings us to another rapid of some length; most of it can be run, but one or two places require a lift out, and it is somewhat difficult to stop in time. After a half mile of good water succeed 60 ch. of shallow rapids, which are best descended by poling, as the water is too low to run free. All these rapids can be passed by two portages on the east side, leading into and out of a small lake. Below the last rapid we enter a crooked lake. The course lies to the left of an Indian house, which will be seen on a point to the west of the entrance of the river.

One and half mile below this lake a fair sized stream enters on the west side, and a mile and a quarter below it a somewhat larger river, the Goose, enters on the same side. This is the route to the Trout river, to be subsequently described.

Below this river is an island showing gneiss, and then a rapid in two cascades, both of which can be run. Twenty chains lower is another rapid over gneiss and mica schist;

there is a sharp fall of three or four feet, and although it might be run I found it advisable to pass down to the west of a small island and make a lift out.

The next rapid is a mile and a half down ; it is fairly heavy and a portage can be made over the rocks on the west side. Some swift water follows, and then two falls, the first of 6 ft. and the second of 15 ft., over coarse banded gneiss ; both portages are on the west side, and short.

Just below this portage we enter an extensive burnt area, extending as far as the junction of this river with the Ground Hog. No more rapids are encountered until very near the confluence, below which no explorations were made. Ten or twelve miles down a large creek enters on the west side. This shows clear water and a coarse sand bed. It is interrupted by falls, rapids and drift wood a few miles up ; along its shores numerous signs of moose were seen. High banks of extremely fine sand are seen in this region, as well as some clay. Stratified clay, which I believe to be continuous with the Night Hawk area, appears a short distance below here. Eight miles below this creek, we meet outcrops of hornblende gneiss, followed by light and dark green compact schists. From this point down, outcrops are scarce, but where seen the rock was Huronian. Several streams enter one on each side being of fair size with gravel bottoms. The land is all clay, and looks favorable to agriculture. The line crosses at 63 miles. The country east to the Ground Hog river is level and sandy, and the only exposure seen was one of Huronian schist at 53½ miles.

ROUTE TO TROUT RIVER.

The Goose river at its mouth is about a chain wide, with low green shores, which give place to burnt areas a mile and three quarters up. A mile further are several small islands and a rapid, with a portage of half a mile on the south side, over gneiss covered by a partial *brulé* and windfall. Just above are two small rapids to pole, where we again enter the green bush, and a half mile beyond make another portage of 10 chains. The soil here is partially clay, but it can not be said to prevail in this district. Above is a small rapid, and then five miles of clear navigation to the last rapid, with a portage half a mile on the north side into Goose lake. The soil is fine white sand, with fair spruce and poplar, covering Laurentian territory, with occasional outcrops of gneiss. Goose lake is a narrow sheet of water, lying north and south, and is fed by three main streams. The largest of these rivers enters at the southwest corner by a rapid, with a fall of five feet, and a rock portage on the southerly side showing coarse porphyritic gneiss. Just above is another portage on the west side of nearly half a mile, to a long narrow lake of five or six miles, showing green shores and occasional outcrops of gneiss, very garnetiferous in places. Above the lake the river is interrupted by many rapids, some of which can be poled, but numerous portages are necessary. Some recent *brulé* occurs, and at the point where I returned an extensive burnt tract of much older date was encountered.

The soil here is ferruginous sand, and the general appearance of the country very rough and decidedly different from the district traversed from the Pishkanogama to this point. The gneiss strikes northeast, and is coarse and well banded, and in places, especially at some rapids, presents a peculiar white and black appearance. Under the microscope it shows hornblende and large crystals of plagioclase, and probably some orthoclase. The hand specimen is slightly gneissoid in structure. It may be a variety of gneiss or a peculiar diorite, approaching monzonite in composition. The stream entering Goose lake at the southern end was also ascended a short distance, and found to be choked with drift-wood ; a well used portage leaves the stream here, and traverses well timbered, fine sandy soil. It evidently constitutes a hunting trail, and was not farther examined.

The third stream into Goose lake constitutes our route, and enters the west side of the lake at the northern edge of a marsh about a mile above the incoming portage. On ascending this stream a short distance, a round pond is seen on the right. The portage leads out of the north side of this, and is about half a mile long over sand hills, with pitch pine and spruce. We now cross a clear water lake, about 30 chains in a northerly direction. The next portage is more than half a mile, and traverses fine open pitch pine and spruce sand hills, to a very swampy and dirty lake. The creek entering Goose lake flows out of this body of water and does not enter the last mentioned lake. The stream enters in the northwest corner, and near here is the portage which is a mile long,

over country similar to the last. It ends on a small creek with clear water, and sand and shingle bottom. It is very shallow and crooked, making it necessary to wade and drag the canoe in many places. Two portages are necessary, the first of ten chains on the right and the second of 25 chains on the same side, above which it is still stony and shallow, to a lake about a mile long. The whole of this stretch is through old *brulé* and sandy soil. It is necessary to force the canoe through the reeds to reach the end of the above lake, where we find a 25 chain portage on the right. This again leads us to the creek, which now expands into a marsh, above which ten chains of very narrow creek brings us to a half mile portage into Shenango lake.

The shores of this lake partake for the most part of the nature of the burnt sandy country above described. The portage out is reached by keeping straight across into the extremity of the deep bay on the westerly side. This portage is a mile and a-quarter long, still in the burnt area, and ends on a little lake (Height of Land portage). An expedition to the northeast, a distance of over three miles, showed the old *brulé* for a half mile, then a belt of green bush with much windfall, followed by a very recently burnt tract with trees still standing. Sandy soil and rough Laurentian gneiss were seen on this trip. The head of the portage out of this lake is somewhat hard to find; it should be looked for a little to the left of the small creek flowing out; it is about a half mile long, still in the *brulé*, and ends on a very dirty and shallow lake, difficult of approach and hard to paddle through. The next portage leads out of the northwest angle of this lake, is a mile and a quarter long, and traverses green bush. The succeeding lake is known as Kanonjapownakoka. Its easterly shore is green, but the rest is burnt, and many high hills are observable surrounding it, particularly one due north of the portage. An attempt was made to reach this elevation by a trip one and a half miles northeast from the north end of the lake. This trip revealed the old *brulé*, with young poplar and jack pine, and reached a small lake from which the peak bears N.E. two miles. I had hoped to obtain a good view of the country from this hill, but so much time was consumed in getting around the lake, and climbing through the very rough *brulé* on the flanks of the hill, that the approach of night rendered it imperative to return to camp. The line crosses Kanonjapownakoka lake at 76 miles 35 chains. The creek out leaves the lake a half mile short of the western extremity on the north side; immediately on entering it we make a half mile portage in the same kind of burnt bush (old sandy *brulé*), and descend the stream 20 ch. to a small lake, burnt all around. Below the lake the creek is a half chain wide, and the navigation is broken by a ten-chain portage on the left side, about two miles down. Another mile, and we enter a small horseshoe shaped lake, with a portage on the north side of the right hand arm. This trail is a half mile long, somewhat hilly, and, like the last lake and creek, lies in green bush, and the large burnt area seems to be permanently passed. There is a considerable descent at this point, and the creek below traverses a marsh one and a half miles to the Trout river. The line crosses a mile and a-half above the confluence, at 81 miles and 39 chains.

TROUT OR MACOZENDA RIVER.

The Trout river presents shores strikingly different from the other streams entering the Moose river, as for some miles it is bordered by a wide marshy belt, and seems at some past time to have occupied a much wider valley, into which it now expands in places, forming lake-like stretches. It was ascended about 18 miles, and presented this character for half that distance, when the current increased a little and continued to an extremely picturesque waterfall of 20 ft. over gneiss, striking east and west, with a portage of six chains on the west side. Above, the water is good, but I did not proceed farther. The shores present in places exposures of highly garnetiferous gneiss, with bands of quartzite and felsite, and a few streaks of white quartzose schists resembling Huronian, but in such small masses as to be of no importance. The upper part shows high hills of sand and gravel, clothed in places with both red and white pine, particularly the former.

Below the line the river is of the same character, and receives several large creeks. About eight miles down the Kapiskasing river enters on the west; at about this point also the marshy shores cease and the river becomes a little more rapid, and enters a series of rapids a couple of miles from the junction.

The first portage is on the right side, and is reached by descending the smaller portion of the river to the right of an island. Gneiss, large spruce and cedar and some clay were observed at this point. Twenty chains lower is a rapid over boulders, with a three chain portage also on the easterly side. A mile more and we enter a third rapid, with about eight feet fall ; this is easily run. The river continues with easy current for many miles. Below the rapids the country gradually becomes more level, and none of the high hills of the upper portion are visible ; the soil seems to be all clay and muddy banks are continuous, while rock outcrops are practically absent. The timber also decreases in size on approaching the low land, and is represented by small black spruce and tamarac. Eight miles below the last rapid we enter an old bru'é which seems to extend many miles to the north, and is probably continuous with the big burnt area on the lower Pishkanogama.

Trout river rises in Trout lake some distance south of the falls, at the head of my explorations. This lake can be reached by a canoe route from Chapleau, which is said to be very difficult with long, heavy portages ; I could obtain no reliable description of this trail, and have made no attempt to map it.

ROUTE FROM TROUT RIVER TO MISSANABIE RIVER.

The Kapiskasing river, where it enters the Trout, is about half the size of the latter stream, and affords uninterrupted navigation for two miles to Kapiskasing lake, which is a fine sheet of water about five miles by three. Very little rock occurs on its shores, but two or three points show exposures of coarse gneiss. Both sand and clay occur, and the latter is well timbered by heavy spruce and poplar, while some pine occurs in the former, particularly on the east side of the long, thin south bay. Near the outlet there is a prosperous Indian village, with about a dozen substantial log houses and a winter post of the H. B. Co.

There are no Indians here in the summer, but they come from Brunswick House in the hunting season. The soil is good, and potatoes were doing well at the time of my visit—Aug. 25. The line crosses the south bay and also the river, entering in the southwest angle of the lake. At the northeast corner a considerable creek enters, which was ascended and found to branch about a mile and a half to the northwest. The left hand division is the more important, and continues about five miles, turning more to the west, where it seems to rise in a large swamp. The soil along this stream is clay and some fine level stretches are met with ; it is rather wet, and much tamarac is present.

A few outcrops of gneiss are seen, and on the flanks of Mount Horden, a considerable hill lying just south of the creek, some diorite was found. On ascending the hill we encounter larger timber, but all much injured by windfall. Although I did not reach the summit, I regard this hill as well as those near the Trout river, and some south of Missanabie lake, as eruptive masses of diorite or diabase.

This creek is evidently much used as a canoe route ; it is well cut out, and where it flows out of the marsh a well trodden portage leads westward about three miles to a river nearly a chain in width. This trail traverses at first an open country of clay and rocky ridges ; it then sinks into a wet valley, where it crosses the creek ; beyond, it passes over clay ridges with poplar, alternating with low, wet areas with scrub spruce. The river at the end of the portage flows into Kapiskasing river ; on descending it a short distance, a tributary on the left enters from Gull lake. It thus constitutes a route to the Missanabie, but is not the one usually travelled.

Returning now to Kapiskasing lake, we find the Upper Kapiskasing river entering by a shallow rapid at the southwest corner of the lake. About three miles up a portage of ten chains on the east side is occasioned by a fall of ten feet. Up to this point the stream has traversed fine clay soil, with large timber. It now becomes swifter and is broken by rapids, a five chain portage being necessary twenty chains above the last. The soil is still clay, but lower and with smaller timber, for three miles to the next portage, of about half a mile over sandy hills with some clay. Above this portage the stream is smaller, and in fact a junction occurs in the rapids, which is not visible from the portage. Another portage is required, after only ten chains of paddling ; it is on the west side, and is five chains in length. A crooked, narrow stream succeeds, broken by several smaller rapids and a heavy fall of 20 feet, with a short portage on the east side,

over a hill of sandy clay. Along this stretch small tamarac and spruce predominate. Above the portage is one rapid to pole, beyond which we soon enter Wart lake (Way-che-che co-me ka). The shores of this lake are for the most part sandy, with only occasional exposures of gneiss in the more northerly parts; towards the south, however, the country is more rocky and elevated, and has been swept by fires. The lake consists of two southerly arms, with a lift out between them, and a northerly extension. The route lies up a considerable creek, entering the west arm about a mile from the southern end. This stream is rather tortuous and traverses a continuously low country, which appears to consist of clay, at least in places; the river bottom, however, is sand. The timber is small, mostly spruce and tamarac, and seems to represent an old brûlé.

About nine miles up this stream we turn to the right, into a small creek not more than eight feet wide at the mouth, and very shallow. It traverses a marshy tract of country, and is so choked by overhanging brush and its volume is so small that throughout its length (five miles) it is necessary to pole. About half way up we touch a small marshy lake of two bulbs, showing some exposures of gneiss, and the large marsh seems to be bounded by some high gneissoid ridges, covered by brûlé of considerable age in sandy soil.

Near the head of navigation on this stream there is a junction with another branch, and just within the left hand fork is a portage of over a mile in a westerly direction, showing open pitch pine groves in sand. This trail ends on the creek very near its origin in Ka-ka-na-qua lake. Some high exposures of gneiss are seen here, and very high gneiss and sand hills to the northeast of the lake; to the east of these hills is a pronounced valley with a small stream flowing north. This valley has almost perpendicular gneiss cliffs in places 100 ft. high, and is crossed by a transverse ravine in which are several marshy lakes, one of which is crossed by the line.

A canoe route leaves Kakanaga lake in the northeast angle, and by means of these lakes reaches the creek which probably communicates with the river from Gull lake, and thus furnishes another route to Kapiskasing. From the top of these gneiss hills a good view was obtained of the country to the north and east, which seems to be very rough, with many elevations of notable magnitude.

The route leaves Kakanaga lake by a portage out of the end of the southwest bay. The trail is a half mile long over burnt sand hills, and ends on a small lake 20 ch. in width. The next portage is due west 30 ch. The first part is sand, with poplar and spruce, like the country east of Kakanaga lake; the latter half is lower, with scrub black spruce. Another 20 ch. lake (Little Bear lake) follows, then a portage of 15 ch. over burnt sand hills. This brings us to a long, narrow and rather dirty lake (Skunk lake), near the north end of which the line crosses at 27 miles and 14 chains. A trip east of the lake shows an extensive brûlé grown up with young poplar and jack pine. The line strikes this brûlé at 93 miles 54 ch. and continues in it across Skunk lake to 98 miles 54 ch. At 96 miles 55 ch. is the summit of the ridge, with a drop of 180 ft. into the valley to the east. This point is sufficiently high to show Mount Horden, which bears due northeast magnetic.

The water of Skunk lake passes out by a creek at the northern end, and a portage of nearly half a mile is required to reach the navigable part of the stream. No further obstruction occurs to Gull or Kioskabic lake, a distance of three miles. This stream has a sandy bottom and is burnt all the way down. The lake has sand beaches, and seems to be bordered by green timber; its waters flow out by a considerable stream at the north. This river was descended a short distance and found to become very rough, with a descent of a hundred feet; a portage passes this part, but it is badly choked by wind-fall and is over very rough country. This creek leads to the Trout river, and is part of the route which connects with Kapiskasing by the long portage near Mount Horden. We are not yet in Missanabie waters, although the portage east of Skunk lake is the height of land between the Upper Kapiskasing water and that of Skunk lake, Gull lake and Gull river, all of which, however, eventually reach the Trout river. The portage out of Gull lake is 10 ch. long at the western end and over sand with good timber. This is the height of land portage between the main rivers; it will be seen therefore that the summit of the divide lies much nearer the Missanabie than the Trout. Beyond the portage are two small lakes connected by a short creek (Bittern lakes), and then a 15 ch. portage over a sand hill of 75 ft. elevation to Sa-gan-de-ba (Catch you by the Hair) lake. A few red

pinces were seen here. The line crosses Sagandeba lake near its south end at 100 miles 25 ch. A creek enters at the south end which seems to drain a low stretch with many small ponds and lakes. The line on leaving the Skunk lake *brulé* traverses a region of large timber, but much injured by windfall. The route does not pass through the lake, but crosses the northern bay and leads out by a portage near the outgoing creek. This trail is a half mile long over sand with good spruce, and enters the creek which we follow a mile through low tamarac country to a small shallow lake (Sucker lake). Below we continue on the stream (Flying Post Brook) a mile to a portage on the left side a half mile long, showing some clay soil and a ridge of diorite, crossing the Laurentian rocks about north and south. For three miles the stream runs through good sandy clay land with fair timber to a rapid with a portage on the south side, followed by a 15 ch. portage on the right over sand. A quarter of a mile below we enter the Missanabie river, the most westerly of the great rivers of the Moose system and the favorite route to James Bay.

In the first half mile above Flying Post Brook are five small rapids, none requiring a portage. A few miles above Hay creek a considerable stream enters on the south side, where the river turns to the east. The aspect of the country along this stretch is low and marshy, with a clay soil along the river at least. This is probably of alluvial origin, as we generally encounter sand inland.

Hay creek is about 20 ft. wide, and issues from a large marsh with grass, which continues for five miles or more up stream. A mile up considerable diorite crops out on the shore, and to the west, beyond the marsh, is a high rocky ridge formed by a main and several minor dikes of diorite, striking north and south.

Several other hills in the region show the same structure. The country here is burnt, and seems to form part of an extensive *brulé* coming from the southwest and crossing the main river above Hay creek, thus surrounding the eastern end of Missanabie lake and stretching to the south.

About three miles up the creek forks into two nearly equal branches, both of which were explored. The easterly arm rises to the southeast of a prominent hill visible from the junction of the two arms, four miles above which point the marshes cease and the stream becomes difficult of navigation, with rapids and logs from the old *brulé*. Sandy soil with boulders predominates.

The westerly branch rises to the south of Missanabie lake. Six or seven miles up is a rapid, beyond which the stream seems to be continuously bad. The country is essentially similar to that seen on the east branch, old *brulé*, sandy soil and exposures of gneiss. This gneiss is highly hornblende, and contains fragments of pre-formed gneiss and dark mica schist; the strike is northeast and the country rock is cut by some belts of very fine porphyritic diabase, striking about east and west. Diorites, which are evidently altered diabases and contain pyrite, occur in some narrow dikes.

East of Hay creek the country shows a succession of gneiss ridges, running north and south, with low wet tracts between. The high land is fine slightly argillaceous sand, and has very large spruce, poplar and pitch pine timber, much damaged by windfall. The lower tracts are filled with a tangled mass of cedar and swamp bushes.

The line crosses Hay creek just below the fork; to the west the soil is sandy clay, with just enough clay to render it slightly adhesive.

The Missanabie for four miles above Hay creek traverses a low region with tamarac and cedar; it then falls about six feet over boulders. The rapid is in two sections; both can be poled, but a little used portage exists on the west side.

Above the rapids the country is more rocky, and a mile and a half up is a fairly heavy fall, with a short portage of five chains on the south side. Here the rocky burnt hills reach the river; and above also, in the lower river bank country they are not far distant inland.

Above this last portage we enter Missanabie lake, and on rounding a point on the south side arrive at New Brunswick House.

A winter road connects this post with Hay creek, and according to Mr. J. Spence the officer in charge, traverses a continuously low swampy country.

At Brunswick House I obtained much valuable information, especially regarding the upper waters of Hay creek, and other connections to the south and east of Missanabie lake. The whole region south of the lake has been burned, but occasional patches of

green are to be seen on the shore, as well as inland, as will be noted from the description of Little Missanabie lake. On both sides of Missanabie lake, as far as Ferry point, although gneiss hills are common, they are of no especial elevation, and are cut in many places by dikes of eruptive diorite. As far as this point, with the exception of a bulb at the northern end of the lake, is seldom more than a half mile wide; beyond, however, it is of somewhat greater width, and the surrounding country is much more elevated. On the south shore, about four miles above Ferry point, we meet belts of diorite, striking s. 20° w., followed by more gneiss, and then a pronounced Huronian area showing massive and schistose examples of the green Huronian rocks, mixed with much diorite, and followed by light green schists, and white highly siliceous belts with pyrite. These rocks rise to considerable elevations (300 ft.), and extend to the peak of the lake and beyond. Many minor varieties of Huronian rocks were noted, all striking from southwest to southeast, and averaging about south.

North of Ferry point is a second division of the lake, stretching to the north and east. No rock but gneiss was observed either here or at the portage in the northwest angle.

The Upper Missanabie, or Little Missanabie river (Missanabie Shi Sibi) enters the lake by a very picturesque fall (Weasichawun) about five miles east of Ferry point on the south side. The portage is in the sandy bay west of the fall; it is about 50 ch. in length, over sand with pitch pine and spruce of moderate size only. The river above is about a chain wide, but of no considerable depth.

Navigation of Little Missanabie River :

First portage :—50 ch.

River : One mile.

Rapid : Pole, and run down.

River : One mile.

Rapid : Portage, five chains on west. Brulé, gneiss, dike of diorite.

River : 20 ch.

Rapid : Pole.

River : 15 ch.

Rapid : Portage on east side, ten chains.

River : Half mile.

Rapid : 20 ch., pole.

Rapid : Portage, 3 ch. on east.

Rapid : Pole.

River : 25 ch.

Rapids : Half mile, portage on west.

Rapid : Portage, five chains on east.

Rapid : Portage, five chains on east.

River : Sixty chains.

Falls : Portage, five chains on east. Fall of 20 ft. Gneiss.

Above this portage we immediately enter Little Missanabie lake, which is a very irregular sheet of water. Its shores were examined all round; the rock is all gneiss, with the exception of a few narrow dikes of diorite. Swampy shores occur at many points, and many stretches of low water with rice and other grasses occur. The soil is largely sand, and the timber is the usual spruce and poplar, with some pitch pine. Many burnt areas occur, and even the green bush is comparatively young. A short portage connects the two southern arms of the lake, from the more easterly of which connection may be made with the railway, but the route is not used.

To reach the railway from Missanabie lake, we make a short portage out of the north-west corner, and traverse a long narrow lake, about ten miles. This lake is surrounded by Laurentian rocks, with the exception of a narrow belt of Huronian about the middle. The portage is at the extreme end, and having crossed it we enter Dog lake, and are on the lake Superior slope. Missanabie station is about eight miles from the portage; the route is very crooked, and is best understood from the map. The line of survey crosses Missanabie lake about two miles south of the post, touches the northern bay and terminates at 120 miles, a short distance north of that body of water.

SUMMARY OF OBSERVATIONS.

Geology : The whole region embraced in this report consists entirely of Laurentian and Huronian rocks, the former being represented by gneisses of various texture and color, passing in many places by gradual transition into granite. I have made no attempt to map separate areas of granite, as it is impossible to delineate clearly their boundaries. Again, where masses of gneiss fade imperceptibly into granite, it is obviously incorrect to ascribe the latter to an independent origin. While true plutonic granites may exist here, and do of course exist elsewhere, my experience, as well as the evidence of authorities, would ascribe these granites to the same origin as the most-banded gneisses.

The Huronian rocks are much the same as elsewhere in northern Ontario, consisting of varieties of schists, altered porphyrites, crushed granites, felsites and quartzites, as well as one exposure of volcanic conglomerate on Mattagami lake, pointing to a pyroclastic origin, and suggesting the rocks of the Lake of the Woods. Many of the schists are well mineralized, and small seams of quartz are not uncommon, although no extensive outcrops were seen. Hard and highly siliceous schists are more common than the softer varieties, and as the latter are more favorable for gold it is advisable to note particularly their occurrence, as is done in the body of this report.

Gold seems to be well distributed over the region ; in fact it may be said to occur in nearly all the Huronian belts, but generally in extremely small quantities. The richest specimen was obtained near the Pigeon Rapid on the Mattagami river, and I regard the region south of the trail to Porcupine lake as giving promise of reward to the prospector. The south arm of Matagaming lake and the river above show traces of gold, and a prospect might prove successful in that region. The Huronian belts are as below :

1. An area touching Muskegogama lake embracing the south arm of Minniesinaqua, and probably connecting with a larger mass to the east.

2. A north-eastern area, sending a spur across Kenogamisse lake, crossing the Mattagami at the Wawiatan portage, and the Ground Hog some distance below the line. This belt sends an arm across the line at $53\frac{1}{2}$ miles, and bends off to the northwest.

3. The Matagaming lake area embraces the Ground Hog waterway from above Sagetownashke lake to below the Meshewasun rapid. Its eastern boundary is approximately shown ; its western seems to be drawn out into several arms, crossing the Pishkanogama at various points.

4. An area embracing the southwest bay of Missinabie lake and stretching into a narrow belt across Long lake.

It should also be mentioned that dikes of diorite break through the gneisses in many places, particularly around Missinabie lake and Hay creek. Eruptions of diorite I also consider accountable for many of the hills in the western half of the region examined.

Timber : More or less pine of very moderate size occurs at many points. The most important are as follows :

Upper Spanish River, Kenogamisse lake, Atchepemeska lake, Pishkanogama lake, and Matagaming lake.

The other timber is birch, poplar, spruce, tamarac and cedar. Much fine large spruce occurs on the first 12 miles of line, and also near the Ground Hog river. The middle part is scarcely as well timbered, but from the Trout river on the spruce is of excellent size and quality where not destroyed by fire; some particularly fine trees were noted near Sagandeba lake. Immense stretches of timber have been destroyed by forest fires. While it is impossible to accurately outline the burnt areas, a rough idea may be gained from the following list.

1. Belt crossing the Spanish river near its source, passing northwest and north, embracing Mesumekenda and neighboring lakes, and terminating as to its northwestern boundary on the west side of Rice lake.

2. A belt, seemingly from the southwest, surrounding the south part of Matagaming lake. Although only occasionally touching the river, this same area probably is continuous with burn patches below Ground Hog lake. Mr. McLeod of Flying Post says that this fire came from Unaplean, and travelled with wonderful speed under the influence of a high southwest wind.

3. A very large burnt area crosses the route between the Pishkanogama and Trout rivers, infringes on the former river below the falls, and is continuous to the north as far as explored.

4. The Trout river is green in places, but below Kapiskasing passes into an extensive burnt tract which may or may not be continuous with the last described region.

5. The rest of the burnt country must be summarized under one head as a region surrounding Missanable lake, and stretching eastward nearly as far as Wart lake. This territory is by no means all burnt, but large patches of it seem to have been stripped of verdure by fires of different ages.

Despite the many fires, immense quantities of spruce and poplar suitable for pulp wood still exist, and much spruce of a sufficient size for other purposes.

Soil: Throughout the whole southern part of the territory explored the soil is sand; as we pass northward patches of clay occur, as well as an admixture of clay in the sand. The continuous clay area, previously designated the Night Hawk lake clay belt, is of enormous extent. Its southern boundary stretches in an undulating line to the vicinity of lake Kapiskasing. Westward of this point it can not be traced, as both varieties of soil, as well as mixtures of the two occur. The boundary might be said to turn south at this lake, and to become lost in the vicinity of Wart lake. Sandy clay and sand predominate beyond.

For agricultural purposes this northern clay belt, as well as many patches south of the line, should prove excellent. Experience only can show if cereals will ripen in the climate, but I have no hesitation in saying that for stock raising the conditions are excellent. Grasses and roots thrive in this soil, and with proper winter protection there should be no difficulty in weathering the inclement season.

Water power: Excellent locations exist almost all over the region; particularly I might mention Kenogamissee portage, Wawiatan portage and Lower Sandy portage, on the Mattagami River.

First Falls above Matagaming lake, Ostandigististagan rapid, on Ground Hog river Falls on Pishkanogama. Upper falls on the Trout.

First falls below Wart lake.

Upper falls on Little Missanable river.

Game: Small game is very scarce in the whole district, partridge and rabbit being almost absent, but duck are more plentiful. Moose are not uncommon, and in some parts seem to be quite numerous; red deer also are seen, but I observed no signs of caribou. Fur bearing animals seem to be yielding the average returns; the lynx however has followed the rabbit, and the beaver is almost exterminated.

Before closing I desire to convey to the gentlemen mentioned below my sincere thanks for various personal kindnesses, as well as valuable information and assistance.

Mr. J. Miller, officer in charge at Fort Mattagami, and Mr. Joseph Moore of the same place.

Mr. McLeod, officer in charge at Flying Post.

Mr. J. Spence, officer in charge at Brunswick House.

Also to Mr. A. Niven, O. L. S., and to Professor Coleman of Toronto University.

COPPER AND IRON REGIONS OF ONTARIO.

By Dr. A. P. Coleman.

In accordance with the instructions of Mr. Archibald Blue, Director of the Bureau of Mines, the summer of 1899 was employed in the examination of the copper-bearing rocks of the Thunder Bay region, the iron range of Michipicoton and the copper deposits near Parry Sound. Professor Arthur B. Willmott took a share in the work as in former years, and with his usual efficiency. As the regions which were to be studied resemble in most respects the great copper and iron mining regions in Michigan and Minnesota, whose development is so far advanced, it was thought desirable to visit some of the more important mines in these States in order to become familiar with the country rocks of the ore deposits, with the character of the ore bodies, and with the methods used in developing them.

Leaving Toronto on June 20, we went by the upper lakes to the Sault Ste. Marie, and thence to Marquette in Michigan, where the iron mines were visited. The Keweenaw copper mining region was next examined, and a few days were spent on the Vermilion and Mesabi iron ranges of Minnesota. After a very instructive journey through these famous mining regions, Fort William was reached on July 1, and our work commenced on Canadian soil. Various copper and silver deposits were examined near this town and on Thunder bay, and an excursion was made by fishing boat along the coast almost to the boundary of Minnesota. We were then instructed by the Director to return to the Sault, and commence an examination of the Michipicoton iron range, which was attracting much attention at the time. This work was followed by a visit to the deposit of iron ore at Pic, after which we returned to Fort William to close up our affairs there, and then went to Toronto. This closed the summer's work for Professor Willmott, but I made an examination of the copper mining region about Parry Sound. When this was completed a short visit was paid to the region south of Georgian bay in order to measure the elevations of some of the raised beaches so well developed there, and the regular summer's work ended on September 2.

Two short expeditions were made later in the season, one to the eastern end of the Province to study the glacial deposits and sea beaches; the other in company with the Director to examine deposits of arsenical gold ore and of nickel-copper ore between lakes Temiscaming and Temagami.

During the summer our methods of travel were varied. On lake Superior a fishing boat was employed; in the Michipicoton country canoes formed the only mode of conveyance; while in the Parry Sound district horses were used on the backwoods roads.

As on former occasions, acknowledgments must be made to mining men, farmers and others interested in the development of the country for their hospitality and aid in various ways. Special thanks are due to the Messrs. Clergue of Sault Ste. Marie and to the officers of the Parry Sound Copper Mining Company for courteous assistance rendered in their respective districts. The maps and reports of the Geological Survey of Canada were of course of the greatest service to us in the regions covered by them. We owe to the courtesy of Professor Winchell, Director of the Minnesota Geological Survey, a valuable set of maps and reports bearing on the iron regions of Minnesota, and the work of several members of the United States Geological Survey has proved of service in the preparation of the following report, especially that of Irving and Van Hise.

COPPER DEPOSITS.

As the first part of our summer's work on Canadian territory had reference specially to certain copper deposits near Port Arthur, the subject of copper mines in general will be discussed first. As an introduction to this, a brief account will be given of our visit

to the famous copper mining region of Keweenaw point in Michigan. This region has often been described, and for detailed accounts of it the reports of the Michigan Survey and Irving's Copper Bearing Rocks of Lake Superior, published by the U.S. Geological Survey, may be consulted.

MINES IN NORTHERN MICHIGAN.

Houghton is the best starting point for a visit to the region, though the most important mines lie to the north of it. The well known School of Mines is established here, and under the guidance of the president, Mr. McNair, and other members of the faculty, we examined its collections and studied the geology of the neighboring mines.

The rocks of the region, the Keweenaw, overlie the Animikie and are perhaps of Cambrian age. They consist of great flows of basic and acid eruptives, and of brown sandstones and conglomerates, the whole broken by faults and tilted from 35° to 80° N.W. The basic eruptives are mainly dark gray diabase (trap) and related rocks very often having the amygdaloidal character, *i.e.* they have been filled with steam bubbles before cooling, and the rounded cavities formed thus have since been filled with such minerals as calcite, epidote, zeolites, etc. The presence of these cavities proves that the rock flowed as a lava; for rocks cooled far below the surface, where the pressure is great, have no chance to let the steam expand. One variety of the diabase has a spotted look, very like that observed at Mamainse. The amygdaloids are a most important source of copper, which sometimes fills the cavities like shot. In other places the rock as a whole is much altered and porous, and irregular masses of copper occur scattered through it. The alteration products generally accompanied by copper are especially chlorite, epidote and prehnite, according to Prof. Seaman. At some mines the altered rock, in which mass copper occurs, is of a pale bluish green, probably because of the chlorite and epidote.

The acid eruptives are much less widely spread, since they formed less fluid lavas. They are generally red or brown, and include felsite, quartz porphyry and quartzless porphyry.

The beds of eruptive rock are very uneven in thickness, and cannot be traced for any great distance, as might be expected of lava flows. They are thicker and less interrupted by sediments in the lower part of the Keweenaw than in the upper part, where conglomerates and sandstones become more and more important, at last being almost free from eruptive rocks.

The conglomerates are generally brown or red in color, and contain chiefly pebbles of felsite and porphyry. In some beds they are rich in copper, especially in the Calumet and Hecla mine, where they furnish most of the output. The upper sandstones seem to carry little copper, only one mine having been sunk upon them. Part of the upper series of sandstones is closely like the St. Mary's sandstone at the "Soo;" and it is possible that the Keweenaw passes up into these rocks. Owing to faulting the relationship of the two is not absolutely certain in the Keweenaw region.

Although most of the mines are on beds of amygdaloids, the amount of copper produced from the great Calumet and Hecla mine, which works mainly conglomerate, surpasses the whole of the others, so that most of the Michigan copper may be credited to the latter rock. A small quantity of silver accompanies the copper, not alloyed with it, but as the pure native metal. This is evidence that the metals have been deposited from solution, but the source of the solution is not wholly clear, though it is probable the basic eruptives, which still contain some copper sulphides, have provided most if not all of it.

Besides the beds of amygdaloid and conglomerate, some copper has been mined from fissure veins, but these are relatively unimportant.

The most extraordinary feature of this great copper region, second only to one other in the world, that of Montana, is the fact that almost the whole of the metal is native, even at the great depths to which mining has reached. This feature is found nowhere in the world outside of the Lake Superior basin, since in all other regions, after the gossan or weathered upper part of the deposit has been removed, sulphides, chiefly copper pyrites, are found. The purity of the metal and the ease with which it is extracted by simple crushing and washing, give the Superior region a great advantage over all others, and Lake copper has long led the way in quality.

The Keweenaw region can boast of the greatest mine in the world, the Calumet and Hecla, with the deepest vertical shaft in the world, the Red Jacket shaft, now about a

mile in depth. Mining, milling and smelting the copper can here be carried with ores very low in the metal; since the Atlantic mine treats ores averaging only 0.61 per cent., and no other mine surpasses 2.00 per cent, except the Calumet and Hecla itself, which reaches 3.05.

As the ore comes up from the shaft, the "mass copper" (large lumps of the metal) is selected out by hand, and the rest is taken by rail to the mill and crushed. Gravity stamps such as are common in gold mills are not used, immense steam stamps, somewhat like those of the Tremaine mill, being used instead. In the Calumet and Hecla mill on lake Linden, the stamps are said to crush 300 tons each per 24 hours, and cast iron stamp heads last only 3 or 4 days. The rock is not crushed nearly so fine as in a gold mill, however, and much of the rock is not so hard as gold quartz. There is an elaborate system of washing the material from the stamps, and the concentrates are of two grades of purity, the tailings being run off into the lake, which is rapidly being filled.

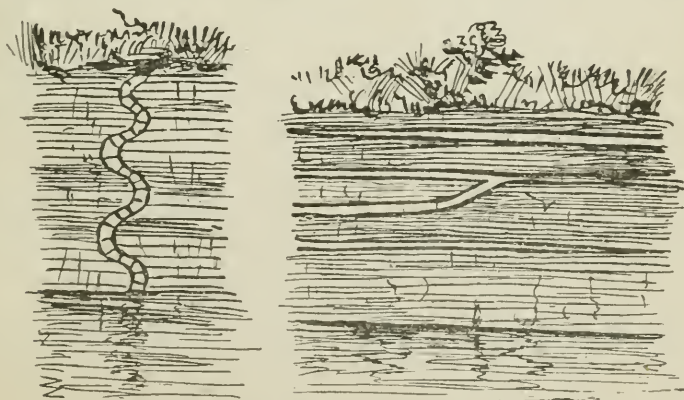
The smelting of the copper is a very short and easy process compared with that of other regions.

Copper has been obtained from Keweenaw point ever since the days of the mound builders; but the first real mine was opened in 1846. Since then the output of copper has steadily increased until, in 1898, 281,125 tons were produced. The Calumet and Hecla mine alone has paid more than \$55,000,000 in dividends on a capital of only \$2,500,000; and its shares, which if at par would be worth only \$25, are quoted at \$895. It should be added, however, that no other mine in the region has approached this level.

So far as the geology is concerned, every rock observed is found also on the north shore of lake Superior, at Mamainse, Michipicoton island, and between Nipigon and Thunder bays. The only important differences noticed between the two regions are in regard to the attitude of the strata, those of Keweenaw point being much more steeply tilted and more intersected with faults than the rocks of the same age on the north shore. It should be added, however, that on Michipicoton island certain rocks occur, such as a black pitchstone, which are scarcely found in the Michigan region.

COPPER AND SILVER NEAR THUNDER BAY.

As we had in the previous summer examined and reported upon the copper deposits north of lake Huron, at Mamainse on the east side of lake Superior and on Michipicoton island in the northern part of the lake, it was decided to investigate the copper bearing rocks on the northwest side of the lake, and to visit any known deposits of copper between Pigeon river on the Minnesota frontier and lake Nipigon to the north. Silver and iron mines in the vicinity of our work were visited also, and attention was directed to the relationships of the Huronian, Animikie and Keweenawan or Nipigon rocks of the district. Owing to the finding of an important iron range at Michipicoton, however, we were called to that region before our work near Thunder bay was far advanced.



Dikes and Sheets of Diabase at Sturgeon Point, Lake Superior. (Coleman).

Our first expedition was toward the Minnesota boundary, traveling in a small fishing boat with Ambrose Cyrette, from the mission opposite Fort William, as guide and boat-

man. As Ambrose had discovered many years ago one of the copper deposits we wished to visit, and also one or two silver mines, and had traversed much of the region as a hunter and prospector, he was specially suited for our work and performed his part of it on the whole very satisfactorily.

There are many references to the mines and their geological associations in the reports of the Canadian Geological Survey, the most complete being Ingall's report on Mines and Mining on Lake Superior.¹

Leaving the Kaministiquia by the southern outlet, the delta deposits are not passed until Whiskey Jack point is reached. Here soft shales with harder layers rise a few feet from the lake and have a gentle dip, about 5° to the northwest. Proceeding south along the shore one sees evenly banded shales or slates, some layers hard, others soft enough to crumble in the hands, often with exceedingly uniform lamination, lying almost horizontally. Some of the thin harder bands are evidently laccolithic sills of diabase, though only an inch or two thick, since occasionally they cut across the slate from one level to another. Thin dikes of similar rock have been thrown into curves by the compression of the strata, and, at the same time, broken into rod-like portions. Larger dikes, some 20 feet or more in thickness, rise through the slate and cut a thick cap (or laccolithic sill) of diabase, the latter apparently sometimes 200 feet thick, near Sturgeon point.

About a mile southeast of the point large stretches of diabase interrupt the slate, rocks weathering into spherical masses, or having many paler greenish spots like certain diabases of the Keweenaw region near Houghton. It is possible that these rocks are eruptions of Keweenaw age.

In order to reach the copper bearing rocks we camped on Cloud bay, a few miles northeast of Pigeon river, and made an excursion inland. Following Cloud creek a short distance by canoe, we reached a farm with good fields of hay, but apparently abandoned; and then walked north over a rough and wet trail to the Pigeon River road, which we followed about two miles, and then struck across country to the northwest toward Cloud lake in the northwestern part of Crooks township, reaching sec. 4, con. II. As it had been more than 20 years since Ambrose had visited the location, of which he was the discoverer, there was some trouble in finding the place. The region crossed, before arriving at the copper mine, consisted chiefly of old lake deposits, forming several terraces; but here cliffs of slate and diabase of the Animikie rose from the level sediments, and to the southwest across Cloud creek there were hills several hundred feet high.

Very little work had been done at the so-called mine, two pits each 10 or 15 feet deep, and a heap of rock removed from them, being all that was to be seen. The openings are on a small ridge running for 100 feet in a direction of about 170° on a steep slope toward a small tributary of Cloud creek. The rock is undoubtedly amygdaloid, very like that of Keweenaw point, and contains small specks of native copper, as well as red and green earthy minerals containing copper. It is greatly weathered, and appears to have been shattered into irregular masses and then cemented with reddish brown breccia. In spite of its shattered condition the amygdaloid appears to be in place, and it is at least 30 or 40 feet thick, the lower part being buried under a talus sloping down towards the creek. We walked more than a mile along a ridge, which seems the continuation of the hill where the openings were made, but saw no more rock in place, though boulders of amygdaloid, of the spotted diabase and of red sandstone, all very much like the rocks of the Michigan copper region, were found here and there along the way.

There seems no doubt that a considerable band of Keweenaw rock, to some extent at least copper bearing, exists a mile or two southeast of Cloud lake; but it is much more easily weathered than the neighboring Animikie rocks, and so is mostly hidden under debris. Whether any parts of the band contain copper enough to be mined at a profit cannot be determined until much more development work has been done.

Another excursion was made to a copper location in Blake township, reached by a walk of 12 miles, principally along the Pigeon River road, which is falling into bad repair, so that at present much of it could hardly be traversed with a wagon where it runs through swamps. There are, however, many square miles of good looking level land, fairly dry and largely clay, along the road. Fires, which have run over the region, have destroyed most of the timber, so that the land could be easily cleared. Timothy and

¹ Geol. Sur. Can. 1887-88, part ii, H.

clover grew rankly along most of the road, and there is some pine in the valley. The road winds greatly, and nowhere touches rock in the part which we followed, though mountainous hills of Animikie rocks rise at points not far from it. The moose are so numerous as to work up the boggy road in places to muck. A path leads off to the east or southeast to the mine, which is about 2 miles from the road, and 3 or 4 miles southwest of Loch Lomond.

The mining operations, which were carried out under the management of Mr. Hardman as mining engineer, consist of a drift running 20 or 25 feet into the face of the steep hill, some trenches and a few small pits. The work has been done just beneath a very steep escarpment of Animikie diabase, in a long slope of talus, running eastward down to a small valley trending about north and south.

The drift was started in amygdaloidal rock fresher than that seen in Crooks township, with small amygdules filled, as in the previous case, chiefly with green delessite (?) and white calcite. In a great many of the lumps on the dump in front of the drift native copper can be seen, so that the rock looks well. However, the drift when entered proves to pass through the amygdaloid into boulder clay, and at the end it strikes solid fresh diabase, dark gray and not at all amygdaloidal, apparently the ordinary diabase of the Animikie laccolitic sills. From the work done it is evident that the amygdaloid is simply a very large separate mass or boulder. Lower down the steep hill-side there is another smaller mass of amygdaloid, about 200 yards from the first. The other small costean pits show no amygdaloid. Careful examination of the hill-side above the two boulders disclosed chiefly fragments of ordinary diabase, a little of the spotted diabase and some slate. An escarpment of slate, covered by a cap of coarse diabase, rises about 100 or 125 feet above the highest mass of amygdaloid.

The presence of these large boulders, or masses of copper bearing rock, may be accounted for in several ways. They may be parts of a great dike cutting the Animikie, or parts of a bed of amygdaloid forming a portion of the Animikie series, or they may represent small areas of Keweenawan rocks, remnants of a great sheet of them covering the Animikie, now completely eroded away, except where small patches have been preserved by walls of Animikie trap brought up beside them by faulting.

There are objections to the first theory, for dike rocks are seldom amygdaloidal, since the expansion of vapor necessary to form the bubble holes can only take place at or near the surface of the ground. At any important depth below the surface the cavities could not form because of the great pressure. The second theory does not seem borne out by the facts, since none of the large number of splendid escarpments of the Animikie along the shores of lake Superior discloses a bed of amygdaloid. In fact there is no evidence that any of the caps of diabase covering the hills of the region, and giving them the strikingly flat topped or *mesa* structure, were ever surface flows. Probably all of them were pushed in between the beds of Animikie slate as sheets or thin lenses at a great depth below the surface. Under these circumstances an amygdaloid could not form.

The third theory seems the most satisfactory, and would account also for the long ridge of amygdaloid rock in Crooks township. It is of course possible, but improbable, that the large masses of amygdaloid were brought by ice to their present position. If the third theory is correct, a trench cut at right angles to the escarpment to a depth of 125 feet should disclose any band of amygdaloid, protected by the harder rocks of the Animikie cliff, from which such masses as are found may have rolled.

Apparently this deposit is the one described by Dr. Lawson in 1890,² or not far from his locality, sec. 8 in con. VI. of Blake township. He inclines to the view that the rock is a dike, but at that time no development work had been done, and he could not know that the amygdaloid masses were apparently boulders. He mentions the occurrence of an outcrop of brownish red sandstone, which we failed to see, which suggested to him that some other theory might be more correct, e.g., the faulting down of overlying beds of Keweenawan (Nipigon) rocks. Samples collected by him were assayed by Mr. F. L. Sperry, then at Sudbury, with the following results:

Sample No. 1, 64 feet above foot of slope.....	1.39 p.c. copper.
No. 2, lowest outcrop	0.27 " "
" No. 3, 64 foot level	2.88 " "
" No. 4, 64 "	3.57 " "

² Am. Geol. vol. v., Jan.-June, 1890, pp. 174-178.

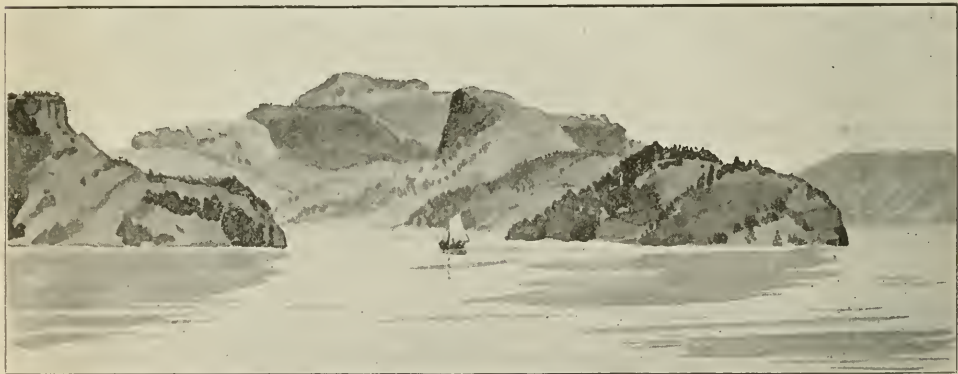
Dr. Lawson mentions also the copper deposit in Crooks township, which he was not able to visit, but at a later time Mr. Hille of Port Arthur visited the spot and obtained specimens. He concludes that "enough has been advanced to show that the Animikie rocks of Thunder bay are worth careful prospecting for copper."

MCKELLAR'S POINT AND ADJACENT ISLANDS.

While in the Cloud Bay region we visited McKellar's point, which projects as a long rocky ridge between Little and Big Trout bays. It has the "mesa" form, a flat topped hill covered with a sheet of diabase, and rises 342 feet above the lake at one point. The



Shore near McKellar's Point, Lake Superior : Pie Island in the distance. (Coleman.)



Trout Bay, Lake Superior. (Coleman.)

diabase (or gabbro) on top is coarse grained and in parts porphyritic, containing large glassy crystals of plagioclase feldspar. A large dike of porphyritic diabase cuts it. Below the capping of eruptive rock are soft slates or shales, with some harder greenish layers, and also beds a foot or two thick of red quartzite, or perhaps felsite. At the Cloud bay mine to the north of the end of McKellar's point a somewhat thick cap of reddish quartzless porphyry forms the top of an escarpment, beneath which are thin fissile slates and thicker beds of bluish gray, less cleavable, slate. Part of this slate has a ropy looking surface as if of lava, though this may be deceptive, and another part contains flat pebbles of darker shale or slate.

Three openings have been made on veins in the slate, a tunnel and a shaft at the western end, and a shaft filled with water at the eastern dump. Probably faulting took

place when the veins were formed, for a breccia of porphyry fragments cemented by calcite makes part of the dump. Calcite is the chief gangue mineral, and a little pyrites is the only metaliferous mineral seen. To the west of the mine there is a higher escarpment, perhaps due to faulting, where the porphyry is not to be seen, the capping being of spotted diabase with slate beneath. The same variety of diabase forms the point between Cloud and Little Trout bays. The rocks mentioned here are evidently similar to those so fully and excellently described by Bayley from Pigeon point in Minnesota, 6 or 8 miles to the southwest.³

On our return from Cloud bay we stopped at Caldwell point, opposite Victoria island, examining reddish granitic looking rocks almost suggesting Laurentian, and also at Jarvis island where a silver mine was worked at various times since 1869, but has long been abandoned.⁴ The white dump of calcite forms a striking landmark against the dark trap rock of the point behind it. A considerable amount of white barite occurs also, and a little pyrite, zincblende and argentite. The adjoining rocks consist of a curious intermixture or breccia of diabase and a syenitic looking rock, as well as some slate. They will be referred to in the petrographic portion of this report.

THE SHORES OF THUNDER BAY.

We now turned back to Thunder bay, intending to study the relationship of the Animikie to the underlying Laurentian, and especially to the Huronian east of Port Arthur. We commenced our work at Current river, a mile or two from the town, where the black slate, covered in places with black trap, has been laid bare by the shallow stream but scarcely at all eroded, the banks consisting merely of the thin sheet of soil and turf covering the rock on each side. As Goose point is approached one notices that the hills in the rear are not flat topped, as they almost always are in the typical Animikie region, but present rounded, rolling forms and are of a whitish color, evidently consisting of Laurentian rock. East of the point coarse granitoid porphyritic gneiss shows itself, and then fine grained somewhat slaty green schist standing almost vertically, with a strike of about east and west. On the edges of the schist there are a few patches of basal conglomerate of the Animikie. If the slaty schist is Huronian, there must have been an immense gap between it and the almost horizontal Animikie which covers it.

The schist is faulted in places, and varies in strike and dip, at one point dipping 70° to the north with a strike of 50°. The band of schist can be followed a long distance along shore, and we estimated its length at 2 or 2½ miles with an observed width of perhaps half a mile, but we did not think it wise to attempt to map it in detail. Narrow veins of quartz occur interbedded with the schist, but not of much promise. Just west of Silver Harbor we found coarse gneiss at the foot of a bay, but could not see the contact between the two rocks. The contact at the western end of the band is an eruptive one, blocks and strips of the schist being enclosed in the Laurentian.

The point at Silver Harbor consists of Animikie, largely chert, which is beautifully banded with black and white, overlain a short distance inland by a bed of diabase which forms an escarpment. The old Algoma silver mine is situated here, but there is very little to be seen of its workings.

The 3A mine lies about a mile inland, and may be reached over a road so grown up with saplings as to be hard to follow. It is interesting as one of the few silver mines of the district located in rocks mapped as Archaean, so we made an excursion to it. The Animikie forms only a strip on the shore, after which a half mile of green schist is passed, then fine grained yellowish gray gneiss or granite in eruptive contact with it; then coarse diabase before the mine is reached. The rock at the mine is dark green and schistose, and similar rock, sometimes weathering red and at times pitted with small spots, which weather more easily than the rest, is found for more than a quarter of a mile north of the mine. Rocky hills beyond this consist of red porphyritic granite. A considerable amount of work has been done, but the mine has been closed for 13 years. The veins strike about 75° and contain quartz, calcite, a little barite and much pyrites. There are many intricate, narrow bedded veins in parts of the country rock, somewhat like the

³ U. S. Geol. Sur. Bull. No. 109, 1893.

⁴ Geol. Sur. Can., 1887-88, part ii., p. 43 H.

arrangement seen at the Alice A. gold mine near Shoal lake. Mr. Ingall's report on the silver mines of the region says that "ores of iron, copper, lead, zinc, nickel and silver with some cobalt and gold" occur in the mine, "the silver being found native and combined with sulphur and nickel"; and the ore is said to have been as rich as that of Silver Islet. One sample is stated to have assayed 25 p. c. nickel and 1.0 p. c. cobalt.⁵

On our return to Fort William we crossed the upper end of Thunder bay and coasted southwestward past lofty cliffs of sandstone. The rock is a rather coarse grained, pale gray freestone, affording large blocks, well suited for building stone. Along the whole shore there are about two hundred feet of sandstone which seems suitable for building stone, and has been taken up as locations for that purpose. As one advances toward Thunder cape some bands of red sandstone appear high up on the cliff. This rock is considered to be of Keweenawan or Nipigon age, though so different in character from the rocks of Keweenaw point. It rests on the Animikie, which can be seen cropping out as a low cliff of slate at the foot of the escarpment. A dike of diabase passes up through both Animikie and Keweenawan, not far from the eastern end of the mountain named Thunder cape. As mentioned in a former report, there is a fault of at least 1300 feet between the Keweenawan sandstones of the eastern end of the peninsula and the bold "mesa" of Animikie diabase forming the cape itself.⁶

Arriving at Fort William we found instructions from Mr. Blue to proceed to the Sault Ste. Marie in order to examine the iron range recently discovered in the Michipicoton district. Our plans for cruising along the north shore of lake Superior to Nipigon bay, and for a canoe trip to lake Nipigon, had therefore to be postponed.

A spare day before the leaving of our steamer was employed in visiting some supposed iron and copper deposits northwest of Port Arthur. The iron ores, which occur on Mr. Morgan's farm beside a creek, are rusty bands of Animikie rock, probably weathered portions of impure siderite; and the supposed copper mine is simply a shaft sunk in the ordinary Animikie rock, it is said, by a Chicago company. As it was full of water, nothing was to be seen in the shaft, but the material dumped from it consisted of blue boulder clay and a shaly conglomerate entirely different from the Keweenawan copper conglomerate. Copper is said to occur in the latter rock, but we found none in our brief examination.

IRON ORE DEPOSITS.

An account of our observations in the iron ranges of Marquette and Tower earlier in the summer will be of value, as showing the character of the ores of these famous iron regions and their accompanying rocks, for the purpose of comparing them with the new and undeveloped range at Michipicoton. No attempt will be made to give detailed descriptions of these ranges, but the main facts will be briefly presented. Those who wish to study them in detail will find admirable guidance in the publications of the State Surveys of Michigan and Minnesota and of the U. S. Geological Surveys. Of special importance are the monographs on the Penokee Iron-bearing District of Michigan and Wisconsin,⁷ and on the Marquette Iron-bearing District of Michigan.⁸ These two exhaustive works give very full accounts of the regions and are admirably illustrated. Their careful work has laid a foundation on which Canadian geologists may build in working out our own iron ranges.

THE MICHIGAN RANGES.

We visited first the Marquette iron range, easily reached by rail from the city of the same name. Most of the mines are near the two inland cities of Ishpeming and Negaunee, but the range extends from Marquette to Michigamme, a distance of nearly 40 miles from east to west. A short account of the geology of the region will be

⁵ Geol. Sur. Can. 1887-88, p. 67 H.

⁶ Bur. Mines, 1896, 6th Ann. Rep., p. 129.

⁷ U. S. Geol. Sur., Monograph xix, by Irving and Van Hise.

⁸ Ibid., Monograph xxviii, by Van Hise, Bayley and Smyth.

abstracted from Van Hise's outline at the beginning of Monograph XXVIII, and afterwards comparisons will be made between the rocks of the region, as observed by us, and corresponding rocks in Ontario.

The rocks of the district comprise three series separated by unconformities, the Basement Complex or Archæan, the Lower Marquette and the Upper Marquette. The Basement Complex consists mainly of massive and schistose rocks, not easily separated into sharply defined series, and includes the granites and gneisses generally called Laurentian in Canada, as well as green schists and eruptives, which would be classed as Huronian or Keewatin. Van Hise excludes all sedimentary rocks from his Archæan.

The Upper and Lower Marquette series, classed as Algonkian by Van Hise, include rocks which would in general be called Huronian in Canada. The Lower Marquette consists of quartzites, dolomites and slates, with the Negaunee iron formation at their summit. Only the last need be described. It is "from 1000 to 1500 feet thick, is non-fragmental, heavily ferruginous throughout, and contains the greater iron deposits of the district. It is therefore called the iron-bearing formation. Large quantities of intrusive greenstones are associated with the formation, the masses of which vary in magnitude from great bosses 2 miles or more long, and a half mile wide to small dikes. . . . Upon the whole, the formation is soft, and occupies lowlands between the more resistant greenstones and the Ajibik quartzite. The formation is underlain by the Siamo slate or Ajibik quartzite into which it grades, and is overlain unconformably by the Upper Marquette series." Petrographically the formation consists of a variety of hornblende schist (gruenerite schist) or slate with magnetite, hematite or limonite, ferruginous chert, jaspilite (jasper rock) and iron ore. The chert and jaspilite are frequently brecciated, the others less frequently. "The sideritic slate is the original form from which the other varieties of rock have originated. The ferruginous cherts differ from the ferruginous slates in that the iron oxide and the chert are largely concentrated into alternate bands." The jaspilite differs from the chert only in being stained red with included hematite. "The iron ores resulted from the concentration of the iron oxides through the downward-percolating waters. These concentration bodies usually occur upon impervious basements in pitching troughs. The pitching troughs are formed by the Siamo slate, the Ajibik quartzite, a mass or dike of greenstone, or by some combination of these. The ore deposits are likely to be of large size where, as a result of the folding, the iron bearing formation is much fractured, thus permitting the ready action of percolating waters. The ore deposits occur at the bottom of the Negaunee formation, within the Negaunee formation, and at the junction of the overlying Ishpeming formation."

The Upper Marquette rocks, the Ishpeming formation, consist of quartzite and a variety of actinolite (gruenerite) schist. At the base of the quartzite there is often a basal conglomerate above the Negaunee iron bearing series, showing that there was an interval of erosion between the two.

We visited first the Jackson mine near Negaunee, the earliest worked in the region, having been first opened in 1845. It is still working, though its best ores have been exhausted, and the ore still obtained is very siliceous. The present output is stated to be used for mixing with other ores in smelting. Large open cuts allow one to study the deposit without difficulty. The ore is largely a lustrous, gray, micaceous hematite, intermixed with thin seams of red jasper, often intricately folded and faulted. A talc schist of a yellow to brown color shows on the hill above, and on the lower side of the most easterly opening the same soft schist occurs, largely changed to impure brown iron ore.

North of the valley we found lean, jaspery ore, too low grade apparently to work. This band has a dip of about 70°, and reminds one of hills on the Mattawin west of Port Arthur, or near Magpie river in the Michipicoton region.

The Negaunee mine, which ships 600 tons per day of ore, running from 57 to 62 per cent. in iron, is situated in a valley to the east of the Jackson mine. The ore seems to be mainly soft hematite, with little or no jasper, and lies in lenses, sometimes 200 to 500 feet across and 50 to 100 feet thick, varying in quality, parts being too lean to ship. Dikes of a rock said to be diorite cut the ore bodies, now largely turned to "paint rock." North of the mine gray slate shows at a railway cutting, and still beyond is a ridge of white quartzite, much like that of the typical Huronian at Echo lake, though the dip is higher.

The Lake Superior mine at Ishpeming was visited, and here also there are large open cuts, showing hard micaceous ore with some jasper. The workings are from 300 to 800 feet deep, and the hard Bessemer ore is said to run 65 per cent of iron. The iron bearing rocks of the Negaunee formation occupy usually the valleys, while masses of greenstone rise as hills on each side, and drilling was going on at several places in order to prospect for new ore bodies. Test pits were being sunk also, in some places penetrating great thicknesses of clay and other drift deposits. This is suggestive for our own Michipicoton range, where the valleys have not yet been carefully prospected.

VERMILION AND MESABI RANGES.

Arriving at Duluth by boat, we made an excursion to Ely, in the Vermilion iron range of Minnesota, which displays in a general way the same relationships in regard to the ore bodies as may be seen in the Marquette region. A trip was made by canoe to the north in order to examine the lower Keewatin as mapped by the Minnesota Geological Survey, and to see its contact with the Laurentian.

The rocks observed correspond petrographically to those of the Keewatin of Ontario, and a deposit of magnetite in hornblende schist occurs on the Brandine property, somewhat like the Atik-oka iron deposits but very much smaller. Dikes of granite penetrate the green schists, as near the border of Laurentian bosses in Ontario.

The most important mine at Ely is the Chandler, and some time was spent in studying its surroundings. The mine is worked by deep mining and caving, and the deep kettle-shaped opening with its rock wall, affords good opportunities to examine the conditions. Red jasper and bluish chert are associated with the ore, which consists of hard and soft hematite, partly dark red in color, partly "blue," i.e. bluish steel gray. The latter variety of ore is often hard enough to scratch steel. Much of the ore is porous, consisting of angular fragments cemented by a later deposit of oxide, a condition greatly facilitating mining. It is probable that the hard angular fragments represent jasper, now replaced by ore. On the northwest side of the opening gray green chloritic schist and altered diabase are seen, dipping 60° to 80° to the southeast. Part of the schist is paler, almost yellow, perhaps sericite schist, and other parts are turned to a brown or purple rock, softer than the rest and approaching iron ore in character. The face of the opening is slickensided in places.

On the southeast side of the mine green chlorite schist is seen, and afterwards altered diabase, so that the ore body appears to lie between bands of altered diabase and chlorite schist. Captain John Pengilly, manager of the Chandler Iron Company, was good enough to give much information regarding the mine and its surroundings. The ore body was in the beginning about 450 by 500 feet in area, and mining has already gone down about 700 feet. There were 40 feet of clay on top of the solid rock, then jasper, which thickens to the eastward. This is really only one of three lenses of ore which have been proved to exist, all parallel to the strike of the country rock, the first that on which the Chandler mine is situated, its eastern portion belonging to the Pioneer mine; next the Zenith mine, and then the Savoy. The Chandler however is the only mine which has yet been largely worked. There are about 500 feet of jasper overlying the eastern end of the Chandler lens, which belongs to the Pioneer mine. The Chandler ore is said to run 65 p. c. iron, with only a trace of sulphur and 0.038 phosphorus, and is all of Bessemer quality. Over 5,000,000 tons have been taken from the mine, which was opened in 1888; and it was expected that 800,000 tons would represent the output for 1899.

It must be remembered that this splendid mine is only about 20 miles from the boundary of Ontario, that two other lenses of ore have been proved to exist between it and the boundary, and that the band of country rock enclosing them has been proved to cross into Ontario. The fact that some of these ore bodies are heavily capped with jasper shows that extensive exploration with the diamond drill may be necessary to locate similar lenses on our territory.

The Tower iron mines were visited the following day, on a continuation of the same range but 20 miles to the southwest. Their general surroundings are much better exposed, since bare hills give access to the rock. Part of the mine was worked as large open cuts in a high hill, displaying well the enclosing country rock. Apparently the ore was capped by banded jasper, often crumpled and broken and with a dip of about 70° . The rocks on each side of the lens are Huronian looking schist, green and chloritic, or pale

yellowish gray sericite schist ; in the latter case apparently sheared quartz porphyry. Part of the green schist is agglomerate, with boulders greatly tailed out. The pale sericite schist if decayed is spoken of as "soap rock," and when impregnated with iron oxide so as to have a red color is "paint rock." Miners expect to find soap rock on each side of the jasper and ore. It is suggestive that soap and paint rocks, precisely like those of Tower or of the Jackson mine, occur at the southeastern edge of the Helen mine at Michipicoton. The ore body at the Tower mine is 50 to 150 feet wide, with some "horses" of jasper, and it has been followed down to 1000 feet, the workings extending down to 850 feet. The ore is mostly of the "hard blue" kind of hematite, and averages about 67 per cent iron, but is a little high in phosphorus. The mine needs no timbering, since its walls are so firm. It ships about 450,000 tons per annum.

An examination of the hill shows that frequently, instead of red jasper interbanded with the steel gray iron ore, a black variety like chert or gray, or pale greenish varieties of silica occur, some of them much like specimens obtained from the Michipicoton region.

A hill at the town of Tower shows a broad exposure of chlorite schist and jasper, the latter in quite irregular bodies or lenses, sometimes forming almost a giant breccia with the schist. Here two openings have been made, disclosing good ore, but the amount present has not been determined. Descriptions of the arrangement of the country rocks and ore bodies at the Chandler and Tower mines may be found in the Iron Ores of Minnesota, by Winchell.⁹ This report states that "the mined iron masses have no regular manner of alternation or position in the strata of the Keewatin. They appear suddenly and irregularly. They have no constant hanging wall nor foot wall. They cannot be followed along the strike for great distances. The largest jasper-ore masses are traceable not more than a mile and a half."¹⁰

A short visit was made to the Biwabik mine on the Mesabi iron range. The Mesabi ore bodies are of quite a different kind from those of the Vermilion, and belong to a different horizon, according to Mr. Spurr of the Minnesota Geological Survey being Animikie or Upper Huronian, which extends to the northeast into Ontario in the neighborhood of Thunder bay.¹¹ As in Ontario, these rocks have usually only a gentle dip, about 10 or 15 degrees, and rest upon the upturned edges of the Keewatin schists or the Laurentian, and Canadian geologists generally look on them as later than Upper Huronian in age, possibly Cambrian.

On the Mesabi range the Animikie is divided into three chief members, the basal quartzite, the iron-bearing member, and the upper slates. The iron-bearing member of the series, the only one which need be further described, is about 800 feet thick and is very variable in character, sometimes cherty or jaspery, sometimes earthy slates, and is of various colors, such as brown, red or green ; but all merging into one another. The iron ore associated with them is also variable, including magnetite, hematite and limonite. As in the Vermilion range, the ore bodies seem to result from the concentration of iron disseminated through the rock as a whole, in certain parts, where impervious basins give a chance for this ; but the Mesabi ore deposits are usually shallow and flat, instead of being lenses running parallel to the dip, as at Ely or Tower. Spurr thinks the source of the iron is to be found in marine glauconite deposits, like some now being formed, and that organisms have played a part in the work. Afterwards percolating surface waters decomposed the glauconite, forming silica and iron oxide, the latter being concentrated in regions of greatest oxidation.¹² He thinks that the iron bearing member of the Mesabi is confined to Minnesota, and does not extend into Ontario, but no very good reason is given for this view.

At the Biwabik mine, near the town of the same name, two large open cuts about 150 feet deep and covering many acres give a good opportunity to study the deposits. About 50 feet of stony till overlie the ore, and must be removed before mining can go on. This work is done with a steam shovel and narrow gauge railway, the clay being heaped in great hills to one side of the mine. Below the clay is a bed of red paint rock, looking like ore but low in iron, then bands of brown hematite and yellow ocher, alternating with

⁹ Bulletin vi, Minn. Geol. Sur., 1891, pp. 47, etc., and 177, etc.

¹⁰ Ibid., p. 61.

¹¹ The Mesabi Iron-bearing Rocks : Spurr, Bull. x, Minn. Geol. Sur., 1894, p. 4.

¹² Ibid., p. 259.

blue ore, which is of the best quality. There are a few white sandy layers, residual silica after the leaching out of the iron compounds, according to Spurr. Most of the ore is soft, but some is hard, and both hematite and limonite are mined; the whole it is said, averaging 60-65 per cent, and reaching Bessemer grade. No jasper was seen, though some of the blue ore is hard enough to scratch steel. The ore is evidently stratified, and has a dip of about 20° away from a rocky hill behind the mine. All the mining is done with steam shovels, the ore being dumped into cars, which when loaded are taken directly to the shipping port. Though the mine is not a very large one for the Mesabi region, it ships about 450,000 tons per annum. The nearest rock, which forms the hill in the rear, consists of grayish graywacke conglomerate; but the thick beds of boulder clay prevent a study of the immediate country rock of the mine.

While the Mesabi mines, where millions of tons of ore are handled with steam shovels only a very few miners being required, are unique in the world, and thus far have no parallel in Ontario, it is too soon to say that no parallel will be found in our Animikie. That impure carbonate ores form considerable beds near Port Arthur, and that immense deposits of hematite occur near the Mattawin river, is certain. The latter ore deposits contain much jasper in some places, and are more steeply tilted than most of the Mesabi rocks, but they seem to correspond better, in some respects, to the conditions of the Mesabi range than to those of the Vermilion. As most of the Mesabi deposits are in low ground, covered with drift and difficult to find, it may be that similar beds remain to be discovered in the Mattawin region. The slaty red hematites of the Mattawin range occur in hills, evidently being harder than some of the adjoining rocks, unlike the Mesabi ore bodies, and the ore also is considerably lower in iron. If deposits should be found in the valleys we may expect them to be more highly concentrated, and therefore richer.

THE MICHIPICOTON IRON RANGE.

While waiting at the Sault Ste. Marie for transportation to Michipicoton Post a visit was made to the pulp mills, where Mr. Sjoestedt showed us his metallurgical plant for the treatment of nickel ores. The ore with which he was experimenting comes from a mine controlled by the Clergues, between Sudbury and Worthington, and is pyrrhotite almost completely free from copper pyrites, something unusual in the Sudbury district. His process requires ore free from copper, so that any bits containing copper pyrite are picked out, and less than $\frac{1}{10}$ per cent. is found in the material treated. The ore is roasted sweet in a furnace arranged for this purpose, and also to supply sulphur dioxide for the manufacture of sulphite pulp. The thoroughly roasted ore is smelted in electric furnaces, having a capacity of about one ton per day, the metal resulting being ferro-nickel suitable for alloying with steel in the manufacture of nickel steel. The ferro-nickel contains about 6 per cent. of the latter metal. This process was devised in the first place to supply sulphurous compounds for the projected paper mill; but as carried out the whole of the ore is utilized, unlike the method adopted by the Canadian Copper Company, where the sulphurous gases are poured into the air in the process of heap roasting, destroying the vegetation for a mile around, and the iron is largely removed as slag in the furnace, while the matte resulting still requires an elaborate treatment before the refined nickel and copper are produced. If Sjoestedt's method is successful, and it is stated to work well on the scale now used, it should form a great advance in the treatment of our nickel ores. Unfortunately, most of our ores are largely mixed with copper pyrites, and so not adapted for the process. Possibly a method of magnetic separation of the magnetic pyrites from the non-magnetic copper ore might be adopted for the ordinary Sudbury ores.

The production of ferro nickel suggests the further advance to nickel steel, and so the need for pure ores to supply the necessary iron. Such ores are found in the Helen mine, owned by the Clergues' company.

By the kindness of Mr. Clergue we were invited to occupy berths on his steam yacht, and thus saved some time in reaching Michipicoton. Landing at little Gros Cap, we rowed round the cape to the iron mine worked years ago. As it has been described in a previous report¹³ and also by Mr. Macfarlane in a report of the Geological Survey¹⁴

¹³ Bur. Mines, 1899, p. 145; also p. 254.

¹⁴ Geol. Sur. Can. 1863-66, pp. 130-1.

it will not be necessary to devote much time to it here. As far as the mine itself is concerned, there is less to be seen than when Macfarlane visited it 35 years ago. He states that in the main shaft the ore was steadily improving, and Capt. Grierson, who had charge of the work, states the same; so that further work on the property may be desirable. The associated rock is called quartzite by Macfarlane, but much of it resembles rather chert or very fine grained sandstone. Four or five feet of this rock with little iron ore form the hanging wall of the deposit, but the rest consists of thin bands of chert or sandstone, and hematite. Massive looking agglomerate forms the adjacent rock to the west, while that to the east is soft, rather fissile, green gray schist. More or less interrupted bands of sandstone occur in the greenstone farther east. The general association resembles that of the Vermilion range, but without the Jasper so characteristic there. Between this and the Helen mine, ten miles to the northeast, the band of iron-bearing rock has not been found. On Gros Cap it runs out into the lake at each end, and has not been observed on the main shore.

THE HELEN MINE.

The Helen mine, at the east end of the pond called Boyer lake, is much more promising and of a quite different nature. At the time of our visit a very rough trail from Wawa lake was the only means of access to the mine, and little work beyond stripping had been done. At present the railway from the harbor at Gros Cap is nearly completed, and will soon afford ready communication. Lake Boyer, which is about $\frac{1}{4}$ mile in length and half as broad, and 650 feet above lake Superior, forms the first of a chain of small lakes flowing into Maggie river. The region is very rugged and hilly, rising almost to a mountain just east of the lake, the highest point being as determined by Mr. Clergue's engineers 443 feet above its level and 1,093 feet above lake Superior, or 1,694 above sea. The depth of this small body of water is said to be 150 feet, but Capt. Williams, in charge of the mine, had sounded near the ore body at the east end and had found only 115 feet. It empties by a little stream having a fall of 26 feet over solid rock into the second pond, Sayers lake, still smaller than Boyer lake, but said to be equally deep; and this lake sends a stream over solid rock also with a considerable fall into the next lake. It is probable that the hollowing of these two lakes out of the rock has some connection with the formation of the ore deposit.

The ore body rises as a point from the east end of Boyer lake, and forms a hill 94 feet above its level at the highest point, from which it sinks in all directions. On July 19 stripping showed that the ore body was at least 450 feet in length from east to west, and 350 in breadth from north to south. As good ore could be seen to extend below the water, the thickness was evidently greater than 90 feet. Since then, as I am informed, on March 21, by the kindness of Mr. F. H. Olergue, the superficial area has been proved to be 650 by 850 feet, and the diamond drill has shown that the ore goes to a distance of at least 188 feet below lake level. An average of analyses of the ore showed 64 p. c. metallic iron, 0.025 sulphur, and 0.045 of phosphorus. It was expected at that time that the ore dock would be ready for shipping on June 1, and that a crushing plant of the capacity of 5,000 tons per day would be in operation on May 1.

The ore on the surface is chiefly hard, somewhat porous limonite; but parts of it are "blue" (steel gray), or have the yellow of ochre, and other parts the red of hematite, so that different varieties are mixed. However the average contents of metallic iron are much above that of limonite, so that most of the ore must be hematite. The ore has sometimes a brecciated look, and often shows grape-like or botryoidal concretionary layers. On the north side some fragments of decayed sandstone occur, cemented by ore and in the ore itself in a few places glassy quartz grains are seen. No pyrites was observed however.

An open cut and short drift to the south of the ore body disclose boulder clay above and ore below, with soft pale schist at the end of the drift, the "soap rock" of the miners on the Vermilion range. The schist next the ore has been impregnated with red iron oxide, and is "paint rock."

A steep ridge of hills rises along the south side of Boyer and Sayers lakes consisting of various schists, first sheared felsite, then gray green schist, probably sheared porphyrite, the latter possibly a dike. On top of the ridge the rock is sheared porphyry or felsite. All of these schists strike about east and west and have a nearly vertical dip.

North of the ore body one finds first 400 or 500 feet of sandstone and chert, interleaved with lean ore, mostly limonite, forming a vertical cliff. A little to the west of this is a breccia of chert, with hematite as cement. Going still further north there is a steep ridge or hill of green schist, with nearly vertical dip and a strike about east and west. For about one-eighth of a mile beyond, one finds steep parallel ridges of similar green schist, making a country very difficult to traverse.

At the outlet of Boyer lake the stream flows over what seems to be very pyritous sandstone, now black and deeply weathered. The next small lake flows over similar but more distinct sandstone, with pyrite and secondary iron ore, and the rocky wall to the west shows some ore. A tunnel runs into the hill on the southeast corner of this lake and discloses a great mass of finely granular impure pyrites. Here and there in the pyrites are fragments of sandstone, and there are some vertical cherty looking layers, as though the sandstone or chert was here filled with sulphide instead of oxide of iron.

At the west end of Sayers lake (the second in the series) the sandstone band appears to be about a fifth of a mile wide, but is broken near the middle by a band of green schist, with a little dark slate, the whole about 200 feet in width. Beyond Ely's camp at the west end of the lake a stream flows down a steep dam of pyritous rock toward the next lake. That each of these two deep little lakes should have a narrow dam of pyritous sandstone cannot be accidental. On the trail south of lake Wawa gray and brownish and green schists are crossed for at least a mile, when a large area of a coarse grained green eruptive, probably weathered diabase, is encountered. Beyond this, at the northeast corner of Wawa lake, is the singular conglomerate referred to in a former report. The ore-bearing sandstone has not been traced to any distance west of Sayers (or Glen) lake; so that it cannot be connected with certainty with the short band described before as crossing the end of little Gros Cap. It may be that the connecting link is buried under the old lake sands of the wide Magpie valley, which cover much of the intervening region.

Turning eastward from the Helen mine, a steep path leads up the hill, which rises 450 feet in a few hundred yards, and turns out to be a comparatively narrow ridge with an eastward trend for about $\frac{3}{4}$ of a mile, when it sinks precipitously to a wide valley. Several costean pits across this ridge give hints of its structure. Apparently the cause of the hill is to be found in a large dike or band of pale bluish gray felsite, exceedingly hard and resistant, forming its backbone.

On the surface this rock is commonly weathered for a few inches and covered with dark brown limonite, which had been taken for ore. Wherever the trenches penetrated the surface, however, the fresh rock appeared, and was always found to contain much iron pyrites, probably the source of the coating of brown iron ore. Parallel to this belt of eruptive rock, which shows no signs of schistose structure so far as seen, we have sandstone and various schists, all striking nearly east and west with nearly vertical dip. One section across the ridge shows the following succession of rocks from south to north:

Fifty yards of soft greenish schist with some quartz veins.

A few feet of greenish and yellowish brown schists.

A little sandstone.

Eighteen yards of felsite.

Eight yards of felsite and green schist.

Twenty-five yards of brown rock greatly weathered, partly schistose.

A considerable width of sandstone and chert banded with iron ore.

Owing to the wooded and rugged character of the hill top, the boundaries of the different bands of rock could not be definitely fixed, except on short stretches opened up by costean pits. The width of the summit of the hill is less than a quarter of a mile. Sections across in other places gave a similar result, though the different rocks seem to vary in thickness from point to point, and at one place somewhat farther west a band of conglomerate or breccia was found near the southern side of the ridge, the angular pebbles consisting chiefly of sandstone and felsite. Next to this on the south is soft yellowish felsite schist, and north of it sandstone. It is doubtful if the breccia is of sedimentary origin. At one point about 150 feet down the north side of the ridge Mr. Ely had commenced to drift into the banded sandstone. The material to be seen consisted of the sandstone interbanded with brown iron ore, and a seam of pure limonite running down through it. He expected to find a body of soft iron ore by means of this drift, but apparently failed in this, since the work has not been continued. So far as our

hasty examination goes, it appears as if the felsite had erupted through the soft sandstone, the greatest thickness being left on the north side.

Returning to the ore deposit at the east end of Boyer lake, it will be noted that its position is a very peculiar one. It forms a large mass at one end of a lake basin with an amphitheater of high hills enclosing it on the north, east and south, the walls rising very steeply on all sides, except towards the west, where the lake empties. The arrangement suggests the impervious troughs in which the ore bodies of the Vermilion and Marquette ranges occur; however, there are certain well marked differences from the American ore deposits. Usually they are more or less covered with banded jasper or chert; while here the corresponding banded chert and sandstone lies entirely to one side, and the ore body rises in a dome-like way, sloping down on all sides towards the hills enclosing it, as if it had been heaped up on the bottom of the basin, instead of having been produced by the slow replacement of sandstone by ore in the original position occupied by the rock.

A second theory is possible, that the body of ore has been formed by the oxidation of pyrites from the sandstones and other rocks around. In this case the pyritous sandstone at the lower end of each of the two small lakes may have provided the iron, and in its decay the hollows of their basins may have been produced. Until mining shall have disclosed the true relations of the ore body to the surrounding rocks, it may be impossible to decide which theory is the correct one. Some features point towards the theory of replacement, e. g., the fragments of sandstone in the ore toward the north side and the occurrence of paint rock and soap rock on the south side; while others fit better with the theory that the deposit was made in an open basin by surface waters. The fact that the ore is largely porous limonite, the arrangement and shape of the ore body, and the fact that it is not covered by any capping of rock, seem to favor the second. Possibly both methods may have been in operation at different times. In any case exploration up to the present shows that millions of tons of excellent ore have resulted, so that the mine bids fair to compare favorably with those of the States south and west of lake Superior. It is possible that the Helen mine has more analogy with the Mesabi than with the Vermilion range, but the rocks enclosing it have all the appearance of Lower Huronian or Keewatin, and not those of the Upper Huronian or Animikie.

THE RANGE TO THE EAST OF HELEN MINE.

As the next point where the iron bearing sandstone had been found was some miles away, near Eleanor lake, we returned to Wawa and set out eastward with canoes. By aneroid we found Wawa lake to be 303 feet lower than Boyer lake, or 347 feet above lake Superior. Our estimate from several aneroid readings the previous summer was 352 feet for Wawa lake, but the results of levels carried out by the railway engineers give a considerably lower elevation, 337.6 feet, and this must be accepted as accurate. Last year's readings should therefore be lowered by about 14 feet.

A short distance south of Eleanor lake, and more than two miles northeast of the hill near the Helen mine, ferriferous sandstone is found again on one of the old Johnston locations; but the rock has not been observed between these two points. As seen on the portage trail between Wawa and Eleanor lakes, the rock forms a steep cliff, the banded sandstone being about 100 yards wide, but not showing any good ore. It has the same appearance as that near Boyer lake, and is accompanied by the same rocks. On the hill top we found no felsite, though that rock appears on the face of the cliff, but sericitic or felsitic schist and greenish eruptions are seen on each side of the sandstone. At one place a little black carbonaceous shale occurs to the south of the schist. The felsite is much narrower than on the hill east of Boyer lake, but weathers with the same rusty surface, suggesting iron ore, and has the same pale gray surface with much pyrites on fresh pieces; no pyrites was seen in the sandstone, however.

The portage between the two lakes follows the old Grasett road, which is still in fair condition at most points, and runs west along the south shore of Eleanor lake, and then bends round its western end and turns north again. We walked about $3\frac{1}{2}$ miles along it to examine the rocks exposed. South of Eleanor lake fissile black slate may be seen, but on bending round the lake to the north, only gray green schist and schist conglomerate or agglomerate, with many variations in strike, was found.

Portaging a mile northeast from a small bay of Eleanor lake, we reached a pond and made another short portage into Loon-skin lake, which we mapped. The lake trends

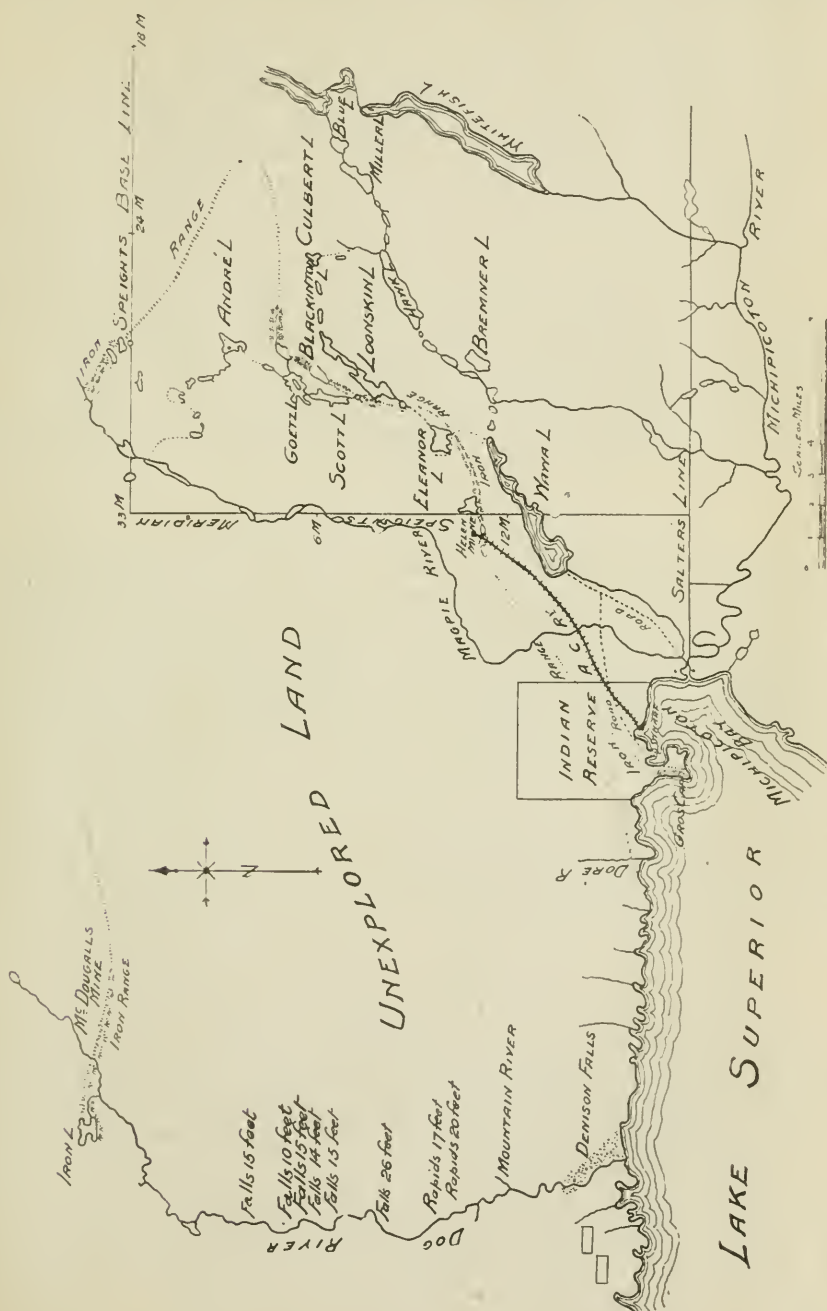
northeast and southwest, has a length of three miles, and is greatly cut up by bays and narrow shallow channels. The rocks observed were all green Huronian, not very schistose. As the portages proved to be very bad, especially for our large Peterboro' canoes, we left most of our stuff at the northeast end of Loon-skin lake, and with one canoe and a light outfit made our way northward to Magpie river. The canoe was rather crowded for four, including our two Indians and ourselves, but served the purpose on the chain of small lakes and rivers we had to traverse. On the numerous portages, often with no path to be found, we carried everything at one load and thus saved much time. As the region had never been mapped, we carried on a track survey with prismatic compass and time allowance. Turning north from the northeastern corner of the larger expansion of Loon-skin lake, two short portages, with a pond between, lead into a small body of water which we named Scott lake, from a gentleman who had suggested this route towards the north. From this lake, which is a mile in length, there is a short portage to the next sheet of water, which we named Goetz lake, from a prospector who had staked claims on its shores. At the southern end of Scott lake there is a hill on which about 150 feet of banded sandstone occurs, with a strike of 75° or 80° and vertical dip. Some of the rock is cherty and reddish, but no good iron ore was to be seen. To the north there is greenish schistose rock. Goetz lake, which is about a mile in length from southwest to northeast, and is divided centrally by a long narrow island having the same trend, shows in general only Huronian schist and eruptives, but the band of iron-bearing sandstone seen on Scott lake runs about parallel to it and is only a quarter of a mile from its eastern corner. Here we found that a number of claims had been staked by Alois Goetz. On No. 2 claim there is black chert in thick beds, while on the south side of a small body of water called Parks lake much red hematite is found in loose blocks, and near by Prof. Willmott has observed red hematite in place. Some of this ore seems to be of excellent quality, but the size of the ore body has not yet been determined. Boulders of limonite were seen at other points of the claims, but the thick moss and the forest covering prevented any careful study of the outcrops, as no stripping had been done. Black slate with a strike of 40° occurs not far off, and at the west end of Parks lake green schist is found, having a strike of from 40° to 60° .

A short portage, followed by a marshy pond, and then a long portage, lead northeast from the upper end of Goetz lake to André lake, a mile and a half away. At the southern end of the pond there is a band of schist conglomerate about 200 yards wide, with well-rounded pebbles of quartz porphyry, felsite and probably sandstone, and with a strike of about 80° . This is half a mile northwest of Parks lake, where the banded sandstone is found.

On André lake only Huronian rocks of the ordinary kind were seen, and the same is true of the chain of small lakes and ponds which we followed toward the northwest. The third lake in the series is of considerable size, but we could not spare time to map its shores. Turning west from this there were three portages with small ponds between, leading over to a small narrow lake where J. H. Scott has taken up a claim. There is a conglomerate or breccia of pale green rock, containing fragments of quartz porphyry. The quartz to be seen is porous and rusty, but we found no gold, though free gold is said to have been obtained there. André has a claim to the west of this, but having little time we did not go to see it. From the small lake there is a portage of about a mile and three-quarters through untouched forest to Magpie river, here expanded so as to appear like a lake. We now canoed up the Magpie for two miles, and then a short distance up a tributary creek, coming in from the northeast. From here we walked to a small lake $2\frac{1}{2}$ miles to the southeast.

Soon after striking inland there was a series of rugged hills, on whose bare surfaces interbanded sandstone and magnetite were to be seen, with a general strike of 100° to 130° . Some of the bands are purple, and approach jasper in character. The banded siliceous rock is often contorted and faulted, and sometimes mixed with sericitic schist. The part highly charged with iron varies in width, 7 yards being about the maximum, but rusty bands more or less parallel to one another occur in places across a space of 80 yards, though only a small part of this can be called ore. Probably all of the ore is too much mixed with sandy granules to be of value. Some vein-like bands near the shore of the lake contain pyrite, but this mineral was not seen elsewhere.

The accompanying rocks are sericitic and chloritic schists, often with a structure like sheared agglomerate. In one such schist the boulders, much drawn out, are pale in color and pitted, while the green basis, present in small quantities, shows no pitting. At one point near the lake there is an outcrop of fine grained granite cutting the schist. Some



Plan showing the Iron Range in Michipicoton Mining Division.

massive diabases also are associated with the schists, but in subordinate amount. All of the rocks have a very steep or vertical dip, and the rugged chain of hills follows their strike. The region has been very thoroughly burnt over, so that exploration is unusually

easy. We did not attempt to follow the sandstones beyond the small lake, but returned the way we came. Most of this range of hills had been staked out as claims by the Messrs. Ganley. None of the ore seen by us is of promising quality, but the diamond drill may disclose ore bodies at some depth below the surface, as in the Vermilion region.

The small lake is about 5 miles north of Parks lake, referred to before, where claims had been staked on similar sandstone with hematite. As the band of iron bearing rock was there running about east, it must make a sharp turn in the meantime, but the intervening portion had not been explored at the time of our examination.

We now ran down the Magpie river, portaged over to Wawa city and retraced our route to the northeastern end of Loon-skin lake, where the second canoe and our main camp had been left. From this point we advanced eastwards with the two canoes for two miles and a half to Cuthbert lake, the route being a very bad one over shallow ponds and along creeks so small that most of the way we had to portage. Cuthbert lake is within the Laurentian, but in this part of the region there are few exposures of rock. From this point we made a portage $\frac{3}{4}$ of a mile south, over level sand plains to McVeigh's creek, a very crooked stream in most parts, emptying into the northeast end of Hawk lake. From this point we followed the usual canoe route via Manitowick lake to Missanabie station on the Canadian Pacific. Near the north end of Manitowick were encamped two prospectors who believed they had found the iron range about 7 miles to the west, not far from Jackfish lake. They had probably struck the range near its bend toward the northwest. They reported that the ore was brown, and that they saw no jasper or sandstone. As they were uncommunicative regarding the route to their find, and no trails had been cut, we decided not to waste time on a search for the deposit.

IRON RANGE NEAR DOG RIVER.

Going by train from Missanabie to White river we made arrangements to visit Mr. W. H. McDougall's iron claims near Dog river. As the canoe route from White river to the point on Dog river where one turns off to the iron locations has been described by Prof. Willmott in a previous report,¹⁵ no further reference need be made to it here. On our way toward the iron deposits we met a party of Minnesota men under Mr. James on their way out after examining one of the claims. They spoke of the iron range as very similar to the Vermilion range, but reported no large deposits of ore in sight, and thought much work might be necessary to develop the region, the best method being by test pits sunk in the low ground.

Iron ores have been found on Iron lake and on Paint lake, the former to the west of Dog river, the latter to the east. To reach Iron lake one turns off a little below Paint creek, making a portage of nearly three miles over sandy plains with open woods to the eastern end of the lake. The portage is broken by two small ponds and a short stretch of navigation on a very crooked creek. Iron lake is nearly three miles long, trends east and west, and is divided down the middle by a very steep rocky ridge, broken about midway with a strait joining the two parts of the lake, which is shaped somewhat like a capital H. This rocky ridge consists mainly of black chert and jasper, interbedded with thin seams of magnetite. The band of siliceous rock is at one point at least 37 yards wide, and may be 30 yards wider, since part of the surface is covered. The top of the hill suggests strongly the hill top showing jasper and iron ore near Tower, but here no bodies of hematite are to be seen. The strike of the band is about 80° and dip from 80° to 90°. The range was followed for about a mile to the west of the strait, and probably extends farther west. The continuation of the ridge to the east of the strait is said to consist largely of the same rock, but we had not time to examine it. The rock along the foot of the cliff is brown schist.

The route into Paint lake starts about three miles up Dog river, near Heart mountain, and runs southeast for $2\frac{1}{2}$ miles over an exceedingly rough trail through densely wooded swamps and up steep rocky hills. Paint lake is small, with a muddy bottom, and the creek flowing out of it is too shallow and crooked for canoe navigation. The usual sandstone crops out near Paint lake, but is accompanied by great masses of magnetite, unlike the thinly banded association of sandstone or chert and iron ore. The masses of magnetite

¹⁵ Ont. Bur. Mines Rep., 1898, p. 140.

contain bands and fragments of sandstone, are very far from being pure ore, and in most places there are many scattered crystals of pyrite, a quite unusual circumstance in other parts of the range. The ore body strikes east and west, and at one place is 100 feet wide, if not more, but with some bands of rock intervening. On the north shore of Paint lake is a deposit of limonite and yellow ocher, from which the name is derived, stretching for about 200 feet, but nowhere very wide and apparently not more than three feet in thickness. Sandstone filled with pyrite, like that at the foot of Boyer and Sayers lakes near the Helen mine, is to be seen cropping out at one or two points on the shore, suggesting that the limonite may have originated in the weathering of pyrite. The magnetite of Paint lake would probably require magnetic separation and roasting to make it of value, and even then would be low grade, since the intermixed particles of magnetite and silica are very fine and hard to separate.

Close to the large mass of impure magnetite there are great veins and irregular masses of white quartz associated with granite, taken up by Mr. McDougall as a gold claim, but of unpromising appearance.

Professor Willmott, who has examined the region a second time since our visit, reports two or three outcrops of sandstone between Iron and Paint lakes, so that they no doubt belong to a continuous belt, but finds that the rock turns north at the latter lake, near the mass of magnetite. There are two other outcrops within a mile to the north, and an iron range a mile in length 5 miles to the east. Apparently the band of iron-bearing sandstone has been thrown into a complex fold with a nearly vertical pitch, or else faulting has taken place on a large scale.

Schist conglomerate is to be seen at several points on Dog river, somewhat northeast of where the iron range is supposed to cross it.

It is probable that the more or less continuous belt of iron bearing rock just described is in reality connected with the belt previously described on the east of Magpie river, but until the stretch of about 10 miles which separates them has been explored this cannot be stated with certainty.

If all the outcrops described, from little Gros Cap to Iron lake, belong to the same band or range, its length is at least 60 miles. Out of this length about 25 miles have been followed up with no gaps greater than a mile or two, and it is entirely probable that careful prospecting will show that the range is continuous. Whether it extends to the west of Iron lake is uncertain, but it may be expected to continue to the end of the area of Huronian schist which it accompanies, and this ends before reaching the watershed between the Bremner and Pucaswa rivers, about 20 miles to the west.

Very similar sandstone associated with iron ore occurs on Pic river, particularly resembling the deposit at Paint lake, and has been briefly described by Prof. Willmott in last year's report.¹⁶ This is about 55 miles to the northwest of Iron lake and separated from it by a wide band of Laurentian, so that no connection can exist between them. Very little prospecting has been done near Pic river, and the extent of the range in that region is unknown.

SILICEOUS IRON ORES OF BATCHAWANA BAY.

It is probable that siliceous iron deposits of a similar kind exist at other points near the shore of lake Superior. A specimen of banded quartzite from cape Oboyye, about 24 miles south of Gros Cap, mentioned by Mr. W. F. Ferrier as included in the petrographical collection sent to the Chicago Exposition in 1893, possibly represents a continuation of the band at Gros Cap; and the deposits north of Batchawana bay about 65 miles from the same point seem to be of a similar character. Mr. Macfarlane says of them that "the Batchawanning ore is situated about 7 miles northwest of the village of that name. The rocks in the neighborhood are diabase, diabase schist, greenstone and greenstone slate, and the latter rock forms the side rock of the deposit. The strike of the ore bed is parallel with that of the enclosing rocks, but its exact direction is difficult to ascertain, as the ore exerts some influence on the needle. It is however about east and west, or a little south of east and north of west. The dip is about 80° to the northward. The ore is principally specular iron, the less compact hematite being comparatively rare. The

¹⁶ Bur. Mines Rep., 1898, p. 257.

specular iron contains an admixture of magnetite, as some of it is attracted by the magnet. Both ores in fine-grained narrow bands are interbedded with similar bands of dark red jasper, and the direction of these bands is parallel with that of the ore bed. This jasper is so plentiful that it becomes a matter of difficulty to obtain a piece of perfectly pure ore of a moderate size, say from 8 to 12 inches in diameter. Although the banded structure is often beautifully regular, it is sometimes found winding and contorted. Minute veins of quartz cross the bands very frequently, and grains of the same mineral are intermixed with the jasper. Iron pyrites also occurs occasionally. The thickness of the bed thus composed is not less than 20 feet, and in some places cannot be less than 40. Many openings have been made at different points on the length of the bed, but nowhere could I observe ore resembling in solidity and richness that of Marquette. Since however at the Jackson and others of the celebrated south shore mines such banded mixtures of ore and jasper are of frequent occurrence, it is not unreasonable to expect that richer masses may yet be found in or around the Batchewaning mine. So far however as the ore at present in sight is concerned, it does not seem possible to excavate any large quantity of it exceeding in richness 30 or 40 per cent."¹⁷

Another account of siliceous iron deposits near Batchawana bay has been given by Mr. J. A. Holmes, state geologist of North Carolina, who examined the region in 1899 for Mr. George C. Heck, of Raleigh, N. C. Thanks are due to Mr. Holmes and Mrs. Heck for their courtesy in allowing me to make use of the information thus obtained. Mr. Holmes "landed near the mouth of Carp river and proceeded on a nearly direct northerly course for the first few miles, following the road bed of the old Batchewaning Iron Company's railway, and beyond that point following a hunter's trail. About 9 miles north of Batchawana bay he found and examined several iron ore deposits which were said by the Indian guide to have been located by Hugh Wilson." The mineral lands are situated about 9 miles east of Pancake bay, and include the Mammoth Iron Mountain location, the Vulcan location, and two other locations. The ore bodies were first described in 1866 by a land surveyor, Mr. Hugh Wilson, and Prof. Robert Bell of Queen's University, now Dr. Bell of the Geological Survey, Ottawa. They speak of a half acre of iron ore surface exposed on a glaciated portion of the Mammoth location, and state that "the ore consists of layers of compact and sometimes crystalline magnetic iron, alternating with others of siliceous slate and quartzose rock, each varying from $\frac{1}{8}$ of an inch to one inch in thickness, the average being half an inch. The slate and quartzose layers generally contain a good deal of iron, sufficient to make them magnetic, but in some cases the quartzose bands are granular upon the surface, and almost free from iron. In some places the seams of pure iron ore form more than half the whole rock, while in others the poorer layers predominate. On the average each variety may be said to form half the mass. The ore is strongly magnetic, and the fragments always exhibit polarity. The ore was traced over an area which was estimated on the ground to measure 50 by 30 chains, and therefore equal to 150 acres, making every allowance it would certainly occupy half that extent. Owing to the contortion and corrugation in the strata, as well as the interruptions caused by the greenstone dikes, it was impossible to estimate the total thickness of the ore, which is probably very great, but I may mention that on the shore of the pond at the northwest corner of the location I saw a clear section of 40 feet across the beds, allowing for contortion, etc., and at the east end of the mountain another of 70 feet." Prof. Bell also gives the analysis of what he considers an average sample of the ore which showed 47.9 per cent. metallic iron.

Concerning his own examination, Mr. Holmes says that the conditions were sufficiently unfavorable to make the results in a measure unsatisfactory, as he was unable to determine the exact position of the locations, so many of the boundary posts had disappeared. On what he supposed to be the locations, he found several outcrops of ore of the character described by Wilson and Bell. Near a pond he found an outcrop exposed for 35 feet, at right angles to the dip, the country rock in the vicinity being rather fine grained compact diabase. To the east of this ore bed for several hundred yards both diabase and gneissic rocks were exposed at intervals.

About a half-mile east of ore bed No. 1 he found a similar ore bed, but more siliceous, striking nearly east and west and dipping 45° to 50° to the south. About 200 or

¹⁷ Geol. Sur. Can., 1866, p. 130.

quality and fair size will prove valuable assets of the Province ; particularly if the steel and other industries resulting from the exploitation of our ores are carried on at home, as there now seems reason to hope will be the case.

While only one deposit, that of the Helen mine, has yet been found to be on a scale comparable to the great mines of Minnesota or Michigan, some of which have produced millions of tons of high grade ore, it must be remembered that the Michipicoton iron range has only been prospected for about a year, that it is in a region almost inaccessible except by canoe, and that up to the present practically no work in the way of diamond drilling or test pits in the low ground has been carried out, except at that mine. Many important mines have been discovered in this way in the States to the south and west, and there is a fair probability that equally good mines will be found in the extensive iron range already traced in Ontario.

It is doubtful if the well-known Atik-okan iron range, still farther to the west, is to be looked on as belonging to the same series of rocks, though it too is mapped as Keewatin or Huronian by the Geological Survey. Its ore is wholly magnetic, accompanied by green chloritic and hornblendic schist, and apparently without bands of jasper or sandstone. In fact it never shows the banded character of the typical iron-range rocks, but occurs as large lenses, 50 or more feet wide, more or less blending into the schistose country rocks. Here also there are ore bodies of very great magnitude, soon to be opened up by the Rainy River railway, and it is probable that these hard magnetites will require some of the softer hematites or limonites of the Michipicoton range to make a favorable mixture for fluxing.

From the brief introductory summary of the conclusions reached by the geologists who have studied the American iron ranges, it will be seen that all the important bodies of iron ore are of secondary origin, the original rock being a low grade ore, a slate with carbonate of iron or a hornblende schist charged with oxide of iron, or the peculiar banded rock so often referred to in the foregoing report. By a process of solution and concentration of the ore in troughs of impervious material, especially where eruptive dikes cut the rocks of the iron range, the immense and wonderfully pure ore deposits have been formed. It is evident that similar structural features will be the most favorable in our iron ranges also ; and the only mine at all carefully explored illustrates this, since its ore body lies in a basin or trough walled on two sides by impervious schists, really sheared eruptive rocks, and on a third by a great dike of felsite. It appears also that owing to their mode of formation the ore bodies are more apt to occur at the lowest points of the range than on the ridges of a hard cherty or jaspery character. Up to the present nearly all the prospecting has been confined to the projecting ridges, a very natural state of affairs where the lower parts of the range are covered with thick layers of drift and hidden by mossy woods. In most parts of the region it will probably be necessary to sink test pits in the low ground in order to find the bodies of ore ; and this of course is likely to be a slow and somewhat expensive process.

PARRY SOUND COPPER REGION.

On August 17 I went to Parry Sound, under the instructions of the Director of the Bureau of Mines, and found that much interest was being manifested in the copper deposits of the region, mining engineers from various parts of America and even from the Old World arriving by almost every steamer to enquire into their value. No doubt the rapid rise in the price of copper had directed the attention of capitalists toward this metal, and had stimulated the search for new deposits. Under the charge of Mr. Robert Forbes, manager of the Parry Sound Copper Mining Company, of Mr. Koren, superintendent of mines, and of Dr. Elftman, superintendent of reduction works, these engineers were shown the workings of the two properties most fully developed, the McGown and Wilcox mines. My thanks also are due to these gentlemen, especially Dr. Elftman, for their courtesy in serving as guides to the mines, in permitting me to make use of their steam yacht to visit some outlying points, and in providing information regarding the assays obtained from their ores and the results of the smelting of six car loads shipped to the Orford Copper Company for treatment.

In the summary report on this region published in last year's report a general account of the two chief mines was given,¹⁹ and it will not be necessary to repeat the description ; but a number of details of more or less interest were noted in addition to the main facts, and the more important points will be given here. By a reference to the former report it will be seen that on the McGown property, two miles east of Parry Sound, there were three openings, the first in order being an inclined shaft about 100 feet on the incline, the second an open pit 21 feet deep, and the third a vertical shaft between the two 9 by 11 in dimensions, and at that time 65 feet in depth. Earlier in the year six carloads of ore, in all weighing 143 tons, had been shipped to the Orford company, and the smelter returns showed that they contained an average of 15 to 16 per cent. copper, with some gold and silver. There were estimated to be 200 tons of selected ore on the stock pile, running from 25 to 30 per cent. copper ; and 3000 tons supposed to contain from 8 to 10 per cent.

The ore which had been shipped came from the open quarry, about 50 by 25 feet in area, and most of the ore on the stock pile was from the same source.

Through the kindness of Dr. Elftman the results of a number of assays of ore and country rocks were placed at my disposal. The ore consisted chiefly of bornite, chalcocite and chalcopyrite, with some pyrite. Assays of chalcopyrite and bornite, mixed, yielded 39.9 to 50.6 per cent. copper. One sample of rock from the quarry contained nickel and arsenic. A piece of nearly solid bornite gave 70.4 copper, a very high percentage for this mineral. An average sample of ore from the southeast corner of the quarry containing some quartz with the copper minerals ran 22.7 per cent. copper, and another average sample 12 feet from the surface ran 25.5 per cent. The rock in which the quarry or open pit is excavated shows only a few stringers of quartz and no indications whatever of a vein, though there are small cavities and vughs in which a little garnet and dogtooth spar may be seen. The rock itself is a coarse gray diorite or norite schist, somewhat intersected by dikes of coarse pegmatite. Small amounts of copper ore occur in the latter rock, and some stripping has been done on a dike to the northeast of the pit.

The rock coming from the vertical shaft is of the same character, but contains much less copper. A sample of apparently barren rock gave 0.8 per cent. of copper ; a hand sorted sample, representing about a third of the rock from the shaft, gave 10.5 per cent. ; and an average of samples taken every two feet round the shaft at depths from 20 to 26 feet gave 3.1 per cent. of copper and half a dollar in gold.

The inclined shaft, which was started by the old McGown Mining Company when gold was the only metal looked for, produces rock which shows a good deal of copper, according to Dr. Elftman's assays, and a small quantity of gold, though no specimens of free gold are to be seen now, plentiful as they were in the earlier days of the mine.²⁰ At 15 feet from the surface samples of quartz ran 0.195 oz. in gold, a trace of silver and 4.8 per cent. copper ; at 23 feet quartz with hornblende rock gave 0.19 oz of gold and 2.2 per cent. copper ; and at 60 feet hornblende rock and quartz gave 0.25 oz. of gold and 6.5 per cent. of copper.

None of the ore bodies have definite outlines, and the deposit is probably caused by an impregnation or replacement of rock by ore, perhaps along a zone of fracture. The belt of rock showing more or less ore is about 250 feet wide at the east end, near McGown lake, widens to about 400 feet toward the west, and is about a 1000 feet in length.

There is not much doubt that the ore-bearing diorite schist is a sheared eruptive mass. Rock of a similar kind is widely spread in the neighborhood with many variations in strike, but generally having a nearly vertical dip.

West of the mine the character of the rock changes and the rocky hills of Parry Sound consist chiefly of fine grained white or flesh colored or gray gneiss, often excessively folded and contorted, and containing large "eyes" of black hornblende and of white felspar, often plagioclase. Some of the latter are two inches in diameter, are well rounded and seem enclosed by a finely crushed rim of the same materials. The gray gneiss sheets fold elaborately around these crystalline masses. These rocks as a whole suggest sediments, probably of pyroclastic (or volcanic) origin ; and their microscopic characters will be discussed in the petrographical portion of this report. Pegmatite dikes ramify in all

¹⁹ Bur. Mines Rep., pp. 259-261.

²⁰ Bur. Mines, 4th An. Rep. 1894, p. 98.

directions in some parts of the gray gneisses, and may account in part at least for the great amount of folding shown by them.

Among the most interesting rocks at Parry Sound are the crystalline limestones, which were studied somewhat carefully for a few days in the hope that they would provide a clue to the stratigraphical arrangement of the rocks of the region. A general account of the limestone bands of the region has been given by Dr. Bell.²¹

It was thought that if they were regularly interbedded with the schists the general relations of the schistose rocks might be made out by following the easily recognized band of limestone. In general these limestones are white, gray or flesh colored, coarsely crystalline, sometimes pure, but often containing darker grains of various silicates, and usually also fragments of adjoining schists, twisted and curled in an extraordinary way as if the limestone had torn them off like an eruptive.

The limestones near Parry Harbor were visited under the guidance of Mr. Adair, who observes such things carefully, and had already studied their distribution. Near Parry Harbor there are apparently two parallel bands of limestone, one with a strike of 55° to 60° and a dip of 25° to the southeast, and a quarter of a mile southwest of this another band with a strike of 65° or 70° and a very gentle dip to the northwest. The direction as well as the angle of dip is variable, and no outcrop can be followed more than a few hundred yards, though a succession of outcrops following the same general direction can be recognized. The thickness too is very irregular, being sometimes more than a 100 feet, and then rapidly thinning out till the bank is lost among other rocks. There is no distinct stratification, and we may suppose that any traces of bedding have been obliterated by the process of crystallization, or by the squeezing to which they have evidently been subjected. As limestone is the softest rock of the region, it has been forced to adapt itself to the forms of the other rock masses. The accompanying schistose rock, gray fine grained gneiss or hornblende schist, is always much contorted and crumpled, and the proximity of the limestone may be recognized in this way, as noticed by Mr. Adair. The various outcrops of limestone near the town, if continuous, would make one or two bands a mile and a half long, probably extending at least four miles to the northeast, since limestone occurs again on the shore and on an island of Mill lake. Whether it continues on in the same direction is uncertain, but several bands will be noted later suggesting this. A small outcrop of limestone is found also at Depot Harbor on Parry island, four miles west of Parry Harbor.

At Rose point, 2 or 3 miles to the south, where the Canada Atlantic railway crosses from the mainland to Parry island, one sees fine grained sandy looking gray gneiss very like that of Parry Sound, with the same eye-like masses of white felspar and black hornblende. At the railway station these ashy looking rocks are thrown into sharp folds with one gently dipping limb, then a sharp bend and a nearly vertical limb, the latter appearing to be to some extent a plane of shearing. Near by are bands of pegmatite of flesh color, mixed with the gray gneiss, and both faulted. On the railway a quarter of a mile east of this there appears to be a great fault, the gray schists being cut off by a coarsely spotted dioritic eruptive rock, now somewhat schistose by shearing. North of the hotel at Rose point there is a hill of rather coarse hornblende schist with many large garnets. The gray gneiss extends to the mouth of Seguin river, a mile southwest of the railway, and the general strike of the region is about 45° or 50° . Similar rocks with crumpled schists occur along the railway to the west until Depot Harbor is reached. On the southwest side of the Harbor there are extensive beds of very garnetiferous gneiss and muscovite mica schist, and also garnetiferous hornblende schist. On the beach near by parts of the sand and gravel are formed entirely of garnets, some an inch in diameter, but much checked, so that no very large clear pieces can be found. In a cutting near the dock banded fine gray gneiss and dark schist occur, having a strike of 75° and dip of 80° to the south. North of the harbor there are bare hills of fine grained yellowish gneiss with a strike of 60° , and dip of 50° to the southeast. As one rounds the point on the way to Parry Sound the dip becomes very low, only 5° or 10° , and just round it the dip appears to be about 10° or 15° in the opposite direction, as if there were a gentle dome or anticline at the point.

It was a surprise to see a well appointed village of several hundred inhabitants, and a busy harbor with three steamers, each 300 feet long and of 17 feet draft lying in it, here

²¹ Geol. Sur. Can., 1876-77, pp. 203-206.

in the midst of the woods on an Indian reserve. A large trade in grain and general freight is done here between Chicago and Duluth on the one side and the Atlantic steamers on the other ; all created within the last few years in what was a wilderness.

THE WILCOX MINE.

The Wilcox mine, owned by the Parry Sound Copper Mining Company, is situated in Cowper township 8 or 9 miles south of Parry Sound, but is best reached by steamer, which makes a circuit of 12 miles to the southwest and then round a peninsula to the head of a long bay. The ore body here is practically a fahlband, with no definite walls but merging into the gray garnetiferous gneiss of the region, and having a strike of about 60° , with a dip of 70° to the northwest. The main fahlband is at various points from 30 to 75 feet wide, as shown by the rusty surface of the rock, and may be traced without much doubt for about 1,000 feet. Half a mile to the northeast rusty rock shows again, and also at a mile and a half in the same direction. Whether they all belong to the same fahlband is of course far from certain. The Lafex mine, 7 miles northeast of the main shaft of the Wilcox, is considered to be on a continuation of the band. Much exploration will be required to prove this, however.

Besides the main fahlband there are smaller bands of rusty rock not far away, running parallel to it, all containing more or less copper pyrites. The main shaft, 9 by 11 feet in dimensions, was 22 feet deep on Aug. 25, and the rock on the dump formed a most singular ore. A coarse textured schist containing chiefly quartz, garnet, biotite and hornblende, is more or less filled with sulphides, especially iron and copper pyrites, the latter minerals sometimes scattered through it in a general way, sometimes running as small stringers. Apparently the presence of large hornblende crystals increases the amount of copper pyrites. Several other minerals occur in small amounts, such as bornite, zincblende, molybdenite and pyrrhotite. Dr. Elftman states that the average ore from the dump runs 4 per cent. copper, that two samples of copper pyrites yielded 20.5 per cent. copper, and that traces of nickel and of gold have been found.

As the Orford company intend, it is said, to establish a copper smelter somewhere on the Georgian bay, perhaps at Parry Sound, and will buy 4 per cent ore at current rates, less 30 cents per ton for transportation, the Wilcox mine should be profitable. From appearances at the time of my visit the ore is probably present in immense quantities, and there is no reason to suppose that the fahlband will not follow the schists down to considerable depths. The important point of course is as to the grade of the ore, which may require careful sorting or other treatment to bring it up to the requirements of a smelter. The appearance of the ore on the dump suggests that the particular band of schist had been shattered, and then infiltrated with iron- and copper-bearing solutions.

OTHER LOCATIONS NEAR GEORGIAN BAY.

The Lafex mine on lot 35, con. 9 of Foley township, about two miles south of Parry Sound, is owned by the Hattie Bell company and is supposed to be on a continuation of the Wilcox fahlband ; however, the character of the ore body and of the country rock are different. The ore consists of iron pyrites, copper pyrites and pyrrhotite, the copper pyrites sometime forming rather thick seams of solid ore, while in other parts iron pyrites and pyrrhotite occur as solid masses, nearly free from any ore of copper. The country rock is dioritic schist, often rusty on the surface from the decay of sulphides. A shaft had been sunk 65 feet and drifting had been carried on for 20 feet to strike a band of pyritous rock exposed on the surface in a test pit 8 or 10 feet deep. The fahlband character is not prominent, as at the Wilcox mine, and the band of good ore is relatively narrow.

The Big Four property on lots 32 and 33, con. 5 of Foley, not far from the Lafex, was visited, but not enough work had been done to permit a careful study. Four pits, the two deepest of them down perhaps six feet, and some stripping, found all the development. A rusty surface, no doubt representing a fahlband, can be followed several hundred feet, with a width at one point of more than 100 feet. The pits, especially the most easterly one, show that the rock is impregnated with much pyrite, less chalcopyrite, and still less pyrrhotite and molybdenite. The country rock is a gray schist, with flesh colored

schist or gneiss not far off. The fahlband resembles in most respects that of the Wilcox mine, which is four miles to the west, but garnets appear to be wanting. Here, as at the Wilcox mine, the copper pyrites occurs in largest amounts near large crystals of black hornblende.

More or less copper ore is found on numbers of the islands in the Georgian bay near Parry Sound, and for some distance to the south, and very showy specimens of pyrrhotite, said to be nickeliferous, are obtained from the Indian reserve on Parry island, but I was unable to visit the locality. On the small islands DB13, 14 and 16 small deposits of iron and copper pyrites may be seen associated with black garnetiferous hornblende schist, pierced by a rather coarse grained purplish anorthosite.

Dr. Elftman has been good enough to give me an account of copper deposits which I was unable to visit in the township of Carling, at the mouth of the Shebeshkong river. The country rock is gneiss, striking 30° west of north. There are three mineral belts running parallel to the strike, the main central one 40 to 100 feet wide and in one place traced continuously over the bare rock for half a mile, when it runs under a swamp. Apparently it reappears a mile away on the other side of the swamp. There are numerous lenses and stringers of quartz in the fahlband, which has a rougher surface than the adjoining rock owing to its being softer and more easily weathered. The quartz veins run from a few inches to 4 feet in width. A pit 4 feet deep and 10 feet wide across the belt, discloses considerable bornite and chalcopyrite, some masses four inches in diameter. The ore occurs both in the quartz and in the rock between. At six other places along the length of the band copper minerals are found, and Dr. Elftman thinks the property the most promising one in the region after the McGown and Wilcox mines.

PROSPECTS INLAND FROM PARRY SOUND.

A considerable number of prospects may be seen within a few miles of Parry Sound, and brief references will be made to some of them. The Cornfield mine on lots 7 and 8, con. 10 of Foley, not far from the McGown mine, and situated in a similar gray gneissoid rock, shows some copper pyrites and a little bornite; and the adjoining Godard property is like it, but neither appears to be of great importance. At the Macdonald property on lots 24 and 25 of the 7th concession of Foley, a shaft has been sunk about 25 feet, showing no vein or regular ore deposit, but copper pyrites and a little bornite disseminated through rather fine grained gray gneiss. There is also some ore in a pegmatite dike near by which contains no quartz, but large crystals of felspar and hornblende in a finer ground. Copper stains may be seen at various points on the farm. The strike of the schistose cleavage is very variable, directions from 0° to 90° having been observed, and in places there is violent folding with dark bands of hornblende schist interbedded, perhaps originally dikes of diabase.

J. McMillan's property, lot 141, con. B of Foley, a mile or two south of the McGown mine, said to have been disposed of to the Imperial Copper Company for \$18,000, is quite interesting geologically. Copper ores, especially bornite, are found distributed through coarse pegmatitic bands of gneiss, in one case a characteristic pegmatite dike having felspar crystals with a bluish shimmer. Stripping has been done and two pits about 6 feet deep sunk, but no vein or definite ore body has been found. Apparently the coarse pegmatite is the bearer of the ore.

On W. J. Nelson's property, lot 19, con. 11 of Foley, the conditions are different, copper pyrites with iron pyrites and garnet occurring partly in coarse gray hornblendic gneiss and partly in a dike of very coarse diorite. At VanKoughnet's, six miles from Parry Sound and a mile south of the Christie road, a little bornite and copper pyrites with some garnet occurs in coarse diorite, the country rock being gray gneiss, the latter also containing a little copper ore with quartz.

Several points were visited in the township of McDougall also, and a few may be mentioned here. On lot 18, con. 1, there are two small openings, one of gray schist or gneiss, the other on a quartz vein, showing chalcocite, bornite and chalcopyrite, mostly diffused through the rock. The quartz vein is of rusty material, suggesting that it might carry gold, but its dimensions are not large, about a foot by 30 feet, so far as could be seen. A similar rock with thin seams of azurite and malachite with a little bornite occurs on lot 17 of the same concession.

It may be added that the copper-bearing belt of rock of the McGown mine extends into McDougall township, but has not been opened up to any important extent, though owned by the same enterprising company.

None of the prospects mentioned have been sufficiently developed to give them any claim to be called a mine, and in most cases there is far too little ore in sight to justify much expenditure upon them. On practically all the properties visited, including some not mentioned above where no work at all had been done, copper ore or copper stains were to be seen, showing that this metal is very widely distributed in the region, but apparently only in small amounts. Nowhere does one see distinct veins or well defined ore bodies, in this respect reminding one of the McGown mine itself, though the latter displays an enormously greater amount of rich bornite and chalcocite ore than any of the neighboring properties. Most of the prospects to be seen inland in Foley and McDougall townships resemble in character the McGown mine rather than the Wilcox, nothing like the extensive fahlbands of the latter with their low grade mixture of iron and copper pyrites having been seen. On the other hand the richer ores, especially bornite and chalcocite, are found only as very small bunches or pockets in the prospecting pits seen by myself.

AGE OF THE PARRY SOUND ROCKS.

The general results of the geological reconnaissance work done near Parry Sound may be summed up here. Scarcely any of the rocks of the region are characteristic members of the typical Lower Laurentian or Ottawa gneiss, though some of the gray gneissoid rocks might not unnaturally be placed there. The absence of associated granites and granite gneisses is suggestive. The ashy looking fine grained gray gneissoid rocks with their "eyes" of feldspar and hornblende are probably sedimentary, in origin perhaps volcanic ash, etc., and are more like the Couchiching of Rainy lake as defined by Lawson than the typical Laurentian. The garnetiferous gneiss and mica and hornblende schist, so common in the region, are certainly not Lower Laurentian; some of them resemble the Keewatin rocks of the Lake of the Woods and Rainy lake, and all are more Huronian than Laurentian in appearance. The widespread outcrops of crystalline limestone may be looked on as decisively against putting the region in the Lower Laurentian, and in favor of considering the whole series of rocks as equal to the Grenville series of eastern Ontario; that is, as belonging to the Upper Laurentian or perhaps Huronian series of rocks, which contain most of the deposits of ores and other economic minerals in Ontario. The general character of the rocks of the Parry Sound district, as suggested in the report of the Bureau of Mines six years ago, is not unfavorable to the finding of valuable mines, since they are not Lower Laurentian.

NORTHERN PART OF THE PARRY SOUND DISTRICT.

As reports of important copper-nickel deposits to the north were attracting attention in Parry Sound, and specimens of the ore showed much resemblance to those of Sudbury, it was decided to go north as far as Hardy and McConkey townships, just south of French river, where the most promising deposits had been discovered. The road selected, by Dunchurch to Loring, was characteristic for the region, including sandy tracts, muskegs crossed by corduroy, and steep rocky hills, with a tract of level clay land more or less taken up by settlers. We drove northwest through McDougall, McKellar and Hagerman townships to the village of Dunchurch. In McKellar township a continuation of the limestone band mentioned as occurring at Mill lake may be seen cropping out at numerous points along the road, and specially well shown at a quarry near McKellar village, where limestone is obtained for burning. It contains many fragments of schist and gneiss, as in the outcrops near Parry Sound, but is said to burn to a white and strong lime, useful for building and other purposes. Large masses of white coarsely crystalline limestone occur at Dunchurch also, where the road crosses a stream, and on the hills to the north near the lake shore. At one point here the band is 36 yards wide and is seen to be not less than 40 feet thick where exposed on the shore.

In the township of Mackenzie some copper ores have been found and one deposit was visited, a vein of white quartz with iron and copper pyrites about 8 feet wide, on

which a pit about 8 feet deep had been sunk. The vein is irregular, but can be traced for some distance in each direction. Samples of the ore are said to have yielded \$5.80 in copper and gold per ton. The country rock is a gray schist.

Lots 34 and 35 on the 4th concession of Ferrie are looked on as containing copper ore, and a pit has been sunk upon a fahlband containing pyrrhotite, but no copper mineral is to be seen. The same lots of the 5th concession were thought to be ore bearing, iron being the metal this time; and a diorite heavily charged with magnetite has given rise to the idea. Some specimens are probably half magnetite, and rock with magnetite covers about two acres; but it is doubtful if any of the ore is rich enough to be of value.

On the 6th concession, lots 32 and 33, a pit has been sunk about 8 feet on coarse diorite, containing pyrrhotite and copper pyrites, but the impregnation does not seem rich enough nor extensive enough to be of value.

Crystalline limestone of a blue color is found on this farm, and at various points for 20 miles along the road from Dunchurch. The other rocks are mainly dioritic schists, often containing garnets; but there is some flesh-colored gneiss, and pegmatite dikes are common. A supposed apatite (phosphate) mine occurs at the crossing of Deer river, really scapolite in crystalline limestone. The road was hilly and rocky for a few miles out of Parry Sound, then came sandy plains, followed by clay land to Dunchurch, with fair looking farms. On the whole the land seems good for at least 20 miles north of Dunchurch, though much of the surface is rocky and hilly.

A prospect on lot 21, con. 9 of Mills township, shows white quartz of unpromising character, but interesting as containing films of native copper. Crystalline limestone is still to be seen at points along the road almost to the southwest corner of Pringle township, where the route turns to the west through hilly country. Here between the limestone and a dioritic rock a seam of graphite occurs, perhaps 2 inches thick at the widest part, and the same mineral is more or less disseminated through the limestone. As scarcely any excavation or stripping has been carried out, the amount of graphite present is very uncertain. Limestone is seen also in crossing the south end of Mills township, but not after the road turns north again. The band of limestone seems to be very extensive, since it has been seen, with numerous interruptions it is true, at points all along the road from Parry Sound, a distance of about 45 miles in a northerly direction. It is probable that careful examination would show the band to be nearly continuous, though it may be that parts of several bands are exposed along the road.

After the second northern bend of the road the rocks have more the look of Lower Laurentian, coarse whitish and reddish gneiss with some darker bands becoming the prevalent species. No granite was observed, but some schistose rocks resembling anorthosite occur. The road for some distance south and west of the village of Loring passes through good clay land with thick woods, mostly hardwood, but containing also hemlock and some pine. There are numerous clearings and fields, showing excellent crops in a colony of Germans; and afterwards a thrifty looking settlement of English speaking people in Golden valley. The crops were chiefly oats, but fields of peas and wheat were also to be seen. A resident of the region says that in spite of the numerous rocky hills and swamps, about a half of the acreage of the farms is arable, and there is a considerable area of rich woodland still unoccupied.

From the village of Loring various locations in the townships of McConkey and Hardy may be visited by canoe or team. The purchase of two or three properties in these townships by the Parry Sound Copper Mining Company has roused great interest in minerals among the settlers, and almost every farm is supposed to have its ore deposit, the test being the presence of rusty surfaces of gossan, "burns" according to the local idea. In a few cases some development work in the way of stripping or sinking pits has been done, and a number of these prospects have been visited and will be mentioned briefly.

LOCATIONS NEAR LORING.

On lot 7, con. 1 of McConkey, a mass of diabase shows rusty surfaces and contains small quantities of pyrrhotite and copper pyrites, a little garnet and magnetite occurring also.

Several prospects have been found near Cariboo lake, on whose eastern shores the predominant rock is flesh colored granitoid gneiss of Lower Laurentian look, but contain-

ing a few veins of quartz with some pyrites. Towards the west end of the lake coarse diabase or gabbro shows itself. On lot 15, con. 4 of McConkey township, north of the lake there are large areas of rusty diabase, and a pit has been sunk about 12 by 15 feet in area and 6 feet deep. The whole mass of rock thrown out shows more or less pyrite and some chalcopyrite and pyrrhotite, and seams of pure sulphides may be seen, but no definite vein is exposed. It is said that an assay of select ore made by Mr. Heys of Toronto gave 1.55 per cent of copper, 1.20 per cent of nickel, and 1 oz., 3 dwt., 8 gr. of platinum per ton. A sample taken by myself from the bottom of the pit was assayed in the Laboratory of the School of Practical Science and gave 0.37 per cent. of nickel, \$1.40 gold, copper none, platinum none.

On lot 18, con. 3, a pit 6 or 8 feet deep has been sunk upon diabase (or diorite) with iron or copper pyrites; and on lot 18 of con. 2 there is an opening on a similar pyritous rock; neither, however, seems of much importance. A specimen from lot 20, con. 3, gave 1.33 per cent. copper and .32 per cent. nickel with a trace of platinum, when assayed by Mr. J. W. Wells.

Several pegmatite dikes appear on the shore of the lake or on islands, and on some of them pits have been opened as mica deposits, from which plates of very fair muscovite several inches square can be obtained. There are also graphitic rocks on the shore of Cariboo lake, but probably not of importance. Most of the pine has been cut near this lake, but there is a considerable amount of hemlock, and very large oak as well as ash and black birch to be seen.

The largest amount of work done upon any property in the region is found at the east end of lake Messagamashine in Hardy township, a little south of one arm of French river and eight miles south of the outlet of lake Nipissing. Here the Parry Sound Copper Mining Company has sunk a shaft about 30 feet deep, unfortunately nearly full of water on Aug. 29. The rock is medium to coarse grained diabase, and the materials on the dump consist of this rock, heavily charged with pyrrhotite, pyrite and chalcopyrite, or of solid masses of these minerals. With the exception of the pyrite, which forms large crystals among the other minerals, this ore greatly resembles some varieties of the Sudbury copper nickel ores. There is a large area of rusty surface near the shaft.

The shores of lake Messagamashine at all other parts except the east end consist of pink gneiss of the Lower Laurentian.

In general the region around the village of Loring is Lower Laurentian in appearance, with numerous basic eruptive masses, chiefly diabase; and the impregnations of ore are found almost only in the latter rock. The majority of the prospects show too little ore to be of importance, and even the two largest openings require much more work before their value is established.

The nearest point on the railway is about 40 miles east of Loring, at Trout creek, with a fair backwoods road most of the way. Crystalline limestone is seen soon after entering Pringle township, showing that the Grenville series replaces the Lower Laurentian, and to the east there are greenish gray schists. On lot 25, con. 7, the Golden Eagle mine is being opened on a band of limestone charged with muscovite, serpentine and a little pyrites. A cross-cut has been made through the limestone, and a shaft was being sunk at the time of my visit, the expectation being that ores of copper and nickel would be found. Nothing on the dump suggested however that these ores occurred in any quantity.

ROCKS NEAR SAND LAKE.

The results of some previous work done in the Parry Sound district in the townships of Proudfoot and Butt, near Sand lake, about 12 miles northeast of Scotia Junction, may be mentioned here. The region to the west, between Sand lake and the town of Kearney, consists largely of sandy plains here and there broken by rocky hills. In general the rocks observed are gray gneisses, coarse or fine grained, and often charged with garnets. The gneiss is often banded with lighter and darker layers, and occasionally flesh colored ones. The mica of the gneiss is generally biotite, but often mixed with muscovite, or altogether replaced by it. Various eruptive masses of a fine grained diorite penetrate it, and a great number of pegmatite dikes. The latter have attracted the attention of prospectors because of the mica crystals they contain. These dikes vary greatly in size

and composition, but even very narrow ones, a foot or less in width, may contain very large individual minerals, both felspar and mica. Most of the dikes contain orthoclase or microcline, plagioclase, very unequally distributed quartz, biotite, magnetite and garnet; all of the minerals in unusually large crystals, except quartz, which seems never to have crystal form. In a few cases muscovite is the only mica, and in others the two micas are mixed. In the largest dike on which work has been done, Dr. Barber's mica mine in Butt township, the various minerals are gigantic in size, microcline crystals reaching a length of three or four feet, mica crystals yielding plates eight or ten inches in size, and garnets beautifully formed but very fragile, perhaps because of the blasting, as much as two inches in diameter. Both varieties of mica occur. In another dike, partly stripped by prospectors, only black mica can be seen, but one crystal had a width of about 24 inches and was several inches in thickness. As this mica is brittle and very opaque, it will probably not be of value, but the muscovite seems of good quality.

Near Elmsdale on the Northern Branch of the Grand Trunk railway an irregular vein of quartz has been opened up as a gold mine, but the ore pile does not look promising. The country rock is diorite or diorite schist, almost black and charged with small garnets. Specimens found near by, and believed in the region to be coal, turn out to be tourmaline.

From the frequency of garnetiferous gneiss it is probable that these rocks belong to the Grenville series, but no crystalline limestones were seen to make the matter certain.

REGION WEST OF LAKE TEMISCAMING.

In company with Mr. Archibald Blue, Director of the Bureau of Mines, a brief visit was made at the latter end of October to deposits of auriferous mispickles and of copper-nickel ore in the region between lakes Temiscaming and Temagami, Mr. Daniel O'Connor serving as guide. The general geology of the region has been excellently mapped and described by Mr. Barlow for the Canadian Geology Survey,²² and his map was of the greatest service during our visit to the region.

The point is most easily reached from Mattawa, whence a railway line follows the Ottawa to the foot of lake Temiscaming. An excellent passenger steamer plies on the lake, which in its lower part is a very narrow fiord-like body of water, but expands at the upper end to a width of five miles, and has a total length of 61 miles. Its shores in the narrow southern part are mountainous and very impressive. At the upper end the shores are lower and broad plains of lacustrine clay afford good farming land.

We set out for the ore deposits which we were to visit by canoe up the Matabichouan river, which empties into lake Temiscaming at the mouth of Montreal river. Some old lake terraces near the mouth of Montreal river afford space for two or three farms, and a wagon road leads inland to a wider tract of good land which stands 226 feet by aneroid above lake Temiscaming, or about 800 feet above the sea. At this level there is an excellent farm with good clay soil, owned by Mr. Bronson of Ottawa, evidently deposited when the lake stood that much higher, as the boulder pavement and rocky shore cliff at one side of the terrace show.

The first portage is long and very steep, and there is a rise between lake Temiscaming and the Bass lakes of 270 feet. From this point the river consists largely of a chain of lakes with short rapids between, the largest body of water being Rabbit lake, which is V-shaped, and affords about ten miles of canoe navigation. The rocks observed up to this are chiefly slate with a fairly perfect cleavage crossing the bedding, and slate conglomerate containing red granite boulders. A portage over morainic boulders forming a flat rapid leads to White Bear lake, where Chief Whitebear's band of Indians have their village. This point we made our headquarters. The chief and some of his men were in our party as canoeemen and showed great efficiency.

A half mile portage over morainic material brings one to Net lake, where the ore deposits were found by Mr. O'Connor. The distance in a straight line from Net lake to

²² Report on the Area included by the Nipissing and Temiscaming Map-Sheets, by A. E. Barlow Report I, vol. x, Can. Geol. Sur., 1899.

the mouth of the Matabitchouan is about 16 miles, but by the crooked course of the river it is about 25 miles, with a fall of more than 380 feet according to Barlow's map. Our aneroid readings correspond well on the whole with the elevations which he has given to the different lakes traversed.

Barlow's report describes the south shore of Net lake as consisting of dark greenish gray felspathic sandstone, followed on the west by intrusive greenstones and flesh red granite, with similar rocks occurring on the east side; and in the main we found the description correct.

The Big Dan claim, a half mile inland on the southwest shore of the lake, contains a large deposit of auriferous mispickel, the surface of gossan stretching more or less continuously for about a third of a mile in the direction $N 30^{\circ} E$, as disclosed by stripping, with a width running in places up to 100 yards. A number of test pits have been sunk upon it, two of them of considerable dimensions. The most southerly pit is 27 feet long, 4 feet wide and three feet deep; and the ore pile beside it consists of altered slate as country rock, mixed with a large amount of pyrite, chalcopyrite and arsenopyrite (mispickel). The next large opening to the north is a trench on the side of a steep hill, disclosing a band of nearly solid mispickel, 59 feet long and a foot thick on the average, running down at least 10 feet as shown in the trench, but having no distinct walls. Assays show this ore to run \$3.70 in gold, \$2.52 in silver and 14.4 per cent. of arsenic per ton. At the foot of the hill and a little northwest of the trench there is another large pit yielding ore rich in mispickel and containing considerable quantities of copper pyrites, but running low in gold and silver. A hundred yards to the north there is another large pit showing a band of ore rich in mispickel, a sample of which assayed \$9.30 in gold and \$1.32 in silver. The assays made on these ores run from less than \$1.00 to \$31.20 in gold and silver, with an average of \$5.75; and all the samples of ore contain more or less arsenic, so that their treatment by ordinary methods would be difficult. It is probable however that the arsenic from carefully selected ore may be an object of importance, since white arsenic is now quoted at $4\frac{1}{2}$ to 5 cents per pound. It is hard to estimate at present the amount of ore likely to be found in the deposit, but it is probably very great. Although an arsenical ore, it differs greatly from the well known ore of Deloro, since it is largely mixed with other sulphides, is associated with little or no quartz, and does not occur in distinct veins, but rather in shear zones or fahlbands in slate, penetrated by dikes and masses of diabase.

Another deposit of arsenical ore with copper pyrites is said to occur not far to the west, and has been taken in hand by the Canadian Copper Company of Sudbury, two shafts having been sunk, one 30 and the other 15 feet deep; but we were unable to visit the claim.

The other claims of the region have been taken up for copper and nickel, and generally resemble those of the Sudbury region. The Canadian Copper Company has a camp on the west shore of Net lake with four log houses and other buildings, but they had just closed for the season on Nov. 1, so that we saw little of their work. The Mukwa claim on the west side of the lake belongs to them, and is said to contain a large body of copper-nickel ore like that of Sudbury; and the Friday No. 1 and 2 claims appear to be similar. On Friday No. 2 there are two openings, displaying heavy masses of pyrrhotite and chalcopyrite, and the rusty rock surface can be traced for a long distance on a hill top.

The Red Hill claim seems to be of a different character, copper pyrites and some pyrrhotite occurring with quartz, in veins sometimes four feet wide, the ore looking like the copper ore of the Bruce mines, though said to contain important amounts of gold.

On the east side of Net lake two claims were visited, the Fairview and the Pike, the former about a mile and a half north of the openings on the Big Dan. On the Fairview there are two small pits and some stripping on a country rock of green slate with gabbro, a little quartzite cropping out near by. The ore is pyrite, pyrrhotite and chalcopyrite with a little arsenopyrite, and except for the pyrite resembles the Sudbury ore in many respects. The amount to be seen is not great however. The Pike claim is a quarter of a mile farther north, and shows a considerable extent of gossan, but the only working is a small pit. The materials on the dump contain pyrrhotite and chalcopyrite like the Sudbury ores, but mixed with a large amount of barren rock.

In general, one may say that ores of nickel and copper undoubtedly occur around Net lake in amounts that will probably prove of importance, but to determine their value

will require a good deal of work. That the Canadian Copper Company have taken hold of some of the claims located here by Mr. O'Connor is good evidence that they consider them of some promise.

In any case it is very significant that 70 miles northeast of Sudbury the same ores occur as at that important mining centre, and apparently in large quantities. It has been shown also that ores very like them are found to the south of lake Nipissing, in a region where Huronian rocks have never been mapped. It is evident that thorough exploration of these vast tracts, covered with forest and moss, and hence difficult to prospect, is likely to disclose great additions to our supplies of nickel and copper ores.

At present access to the Net lake region is difficult, so that the bringing in of supplies is expensive, costing in summer about \$1.50 per hundred weight, since everything must go by canoe. In winter, however, the cost may be reduced to 50 cents per hundred weight, by teaming in with sleighs. Easier access could be obtained without any very great outlay, as suggested by Mr. O'Connor, by building a road about eight miles long from lake Temiscaming to Rabbit chute at the northeastern end of Rabbit lake, and putting a steamer on the lake. A dam at Rabbit chute about six feet high would give navigation to the head of White Bear lake. There is a fall of 75 feet on the Matabitchouan river between Rabbit and Bass lakes, and part or all of this might be used for power to run a tram line from lake Temiscaming, making transit easy. There is a large amount of white and red pine to the north and west of White Bear lake, forming an additional reason for opening up the country.

BAIE DES PÈRES.

As we had a spare day before the steamer went down the lake, we crossed over to Ville Marie or Baie des Pères, on the Quebec side of lake Temiscaming, to examine the interesting contact of granite and quartzite conglomerate described by Barlow and Ferrier three years ago²³, as perhaps the only instance where the original floor on which the Huronian rocks were deposited was still preserved. Granite is mapped as forming the two points enclosing Kelly bay, in which Baie des Pères is situated, and also the opposite or Ontario shore of lake Temiscaming. Just south of the village the green, rather coarse-textured quartzite is seen to rest on granite, and to contain angular fragments of all sizes of a greenish granitic rock, evidently greatly altered from the coarse red granite on the point. As described by Barlow and Ferrier, all transitions between the two rocks can be seen, and evidence seems clear that the quartzite, at least in its lower parts, is formed from the rock on which it rests, which must therefore have been solid but greatly weathered granite at the time. An excursion to the north point enclosing the bay showed similar relations, red coarse-grained granite, penetrated by dikes of pegmatite and also of finer-grained granite, becomes greenish gray a little higher up, and is then followed by a granite breccia with large and small blocks cemented by fine-grained chloritic rock. Above this came ordinary quartzite conglomerate in which Mr. Blue found pebbles of red jasper, proving that this basal conglomerate or breccia was formed after the beds of jasper existed, and therefore could not be at the base of the sedimentary rocks of the region. A further discussion of this point will be given later in describing the relations of Upper and Lower Huronian in Ontario.

A short excursion was made inland to see the old lake terraces and to examine the clays. The farming land of the region stretches miles inland, sometimes between rocky walls of hills, and includes parts of three or four townships. It is white and chalky in appearance and evenly stratified, and was no doubt laid down when the water stood at least 300 feet higher than now. About $2\frac{1}{2}$ miles northeast of Ville Marie church there is a small patch of soft crumbling limestone, largely filled with quartz particles, probably an outlier of the large area of Niagara limestone forming Mann island and part of the mainland north of Temiscaming. It is probable that the lake deposits of whitish clay have originated in the destruction of the limestones in the parts now occupied by the lake, so that the Niagara beds have provided the materials for the extensive and excellent

²³ On the Relations and Structures of certain Granites and Associated Arkoses on Lake Temiscaming, Rep. B. A. A. S., Toronto, 1897, pp. 656-660.

areas of farming land on both the Quebec and Ontario sides of lake Temiscaming, now filling up with settlers and promising to become important agricultural districts. Owing to the great depth of the lower end of lake Temiscaming, navigation remains open very late in the season, even into December, and gives a longer outlet toward the railway than could be expected from this seemingly remote corner of the country.

PLEISTOCENE GEOLOGY.

OLD LAKE BEACHES.

During our past summer's work the chief points in the Pleistocene geology of the regions traversed were carefully noted, and special attention was given to the old lake beaches on the northeastern and northwestern shores of lake Superior. Many raised beaches have been measured previously by various observers, especially Dr. A. C. Lawson²¹ and the staff of the Bureau of Mines,²² but the number of elevations is so great and the difference in height between successive beaches is so small, that thus far it has proved impossible to trace a given beach for great distance around the basin of lake Superior. The fact that many of the old beaches have a succession of wave-built gravel ridges, rising gradually as one walks inland, adds much to the difficulty.

Last summer our work lay mainly on the shore between Port Arthur and the Minnesota boundary at the west end of lake Superior, and between Michipicoton bay and the Canadian Pacific railway on the north.

A number of old beaches were observed on the south side of lake Superior, especially near Houghton in the copper region of Michigan, where Houghton and Hancock are built on a well marked terrace rising 40 or 50 feet above the lake; while a highest terrace rises about 600 feet, reaching therefore about 1,200 feet above sea level. This beach appears to be higher than any hitherto recorded on the north shore, except two on Mt. Josephine just south of Pigeon point in Minnesota, observed by Lawson,²³ and three rather doubtful ones observed by myself, two on Pucaswa river and one northwest of the "Soo."²⁴ Mr. F. B. Taylor has described beaches on lake Kaministiquia, west of Port Arthur, as rising still higher, apparently to 670 feet about lake Superior, but these levels seem to belong to a comparatively small lake dammed by the retreating ice before much of the basin of lake Superior was open.²⁵ This year's work is of interest as showing the existence of a new series of beaches near the watershed between Dog and White rivers, rising much higher yet, the most elevated reaching the level of 843 feet above Superior or 1445 feet above sea level.

Near Cloud creek on the Pigeon river road, leading from the international boundary towards Fort William, a series of terraces may be seen, the lowest rising only 15 feet above the lake. This is well developed on the main shore opposite Victoria island, where well rounded pebbles form a terrace, evidently wave built. In the thoroughly sheltered position of this beach wave action could not build to that height. The beach is more or less bush-covered. The next level is found farther inland, where a plain near Cloud creek slopes gently up from 80 to 100 feet, and a third rises from 236 to 248 feet at the rear of the terrace. Gravel shows upon the latter, but not very well rounded. Lawson records beaches at 8.4, 82.2, 89.7 and 101.4 feet near McKellar's point not far from our observations, which may correspond to our lower beach levels, but does not indicate one at the higher level.²⁶

The next series of terraces to be mentioned lies near Wawa lake, and completes the work referred to in last year's report under the head of Michipicoton Post. Mr. Clergue's engineers make Wawa lake 337.6 feet above lake Superior, and a terrace to the north stands 68 feet higher as determined by hand level, or 406 feet above lake Superior, cor-

²¹ Geol. Sur. Minn. 20th, Ann. Rep., p. 182, etc.

²² Bur. Mines, vol. vii. 2nd Part, 1893, p. 150, etc.

²³ Geol. Sur. Minn., 20th An. Rep. for 1891, p. 252-3. ²⁴ Bur. Mines, 1899, p. 155.

²⁵ Am. Geol. vol. xx, Aug. 1897, p. 117.

²⁶ Geol. Sur. Minn., 20th An. Rep., Table of Elevations, p. 280.

responding fairly well with Professor Willmott's determination of 420 feet. A second water level was determined on the sandy plain between Wawa and the next lake to the east on the canoe route to Missanabie. This stands 111 feet above Wawa, and therefore 449 feet above Superior. It may correspond to a terrace reported by Professor Willmott as lying to the north at a level of 441 feet.³⁰ Professor Willmott reports two higher water levels in the neighborhood, or perhaps only two stages of the same beach, on extensive sand plains near Magpie river, the lower at 536 feet and the higher at 564 feet above lake Superior, the latter being the more accurately determined. The lower terrace rises about 100 feet above Magpie river, sixteen miles below Magpie lake, and cut banks show stratified clay under sand.

Of greater interest are the well marked terraces found 30 miles to the northwest, near the watershed between Dog river emptying west of Michipicoton bay and White river. On Obatonga lake, an expansion of Dog river, a sandy terrace rising about 25 feet above the water, has an elevation of 780 feet above Superior; while a still higher one is crossed on the mountain portage, between McMaster lake at the head of Dog river and Pokay lake, which empties into White river, well rounded coarse gravel and stones forming a distinct terrace at 843 feet above lake Superior, or 1,445 above the sea. The same terrace has been seen by Professor Willmott at the other end of Pokay lake, about 4 miles to the north, proving that it is of considerable extent. This is by far the highest water level yet recorded northeast of lake Superior, though not so high as some beaches mentioned by Dr. Spencer and the Bureau of Mines from the peninsula between the Georgian bay and lake Huron, 150 or more miles to the southeast.³¹ Dr. Spencer's highest beach at Dundalk is 1,690 feet above the sea;³² and he mentions another water level, the Proton plains, at 1,630; while our highest measurement on the Blue mountains near Collingwood is 1,521 feet. It may be mentioned that the terrace above Pokay lake stands 340 feet above the lowest pass towards Hudson bay, the watershed between Dog lake and the headwaters of Moose river, and so must have been formed in a lake having an ice dam of considerable thickness, or else in an arm of the sea deep enough to submerge all but the higher points in the region. So far no fossils have been found in these beaches to decide between the two theories. So wide a body of salt water, connecting on the one hand with Hudson bay and on the other with the gulf of St. Lawrence, must, one would think, have left distinct evidence of its presence in the way of shells or of other fossils; while an ice-dammed lake might well be almost lifeless, and so leave no fossils.

TERRACES NEAR MEAFORD.

In order to obtain further data concerning the high level beaches on the peninsula between Georgian bay and lake Huron, two days were employed in the neighborhood of Meaford. An excursion northwest of the town to cape Rich disclosed a number of terraces and wave-built gravel ridges, but not at very high levels. At cape Rich itself a well marked terrace with a boulder pavement is found from 46 to 56 feet above lake Huron; and a higher terrace of the same kind, running from 63 to 82 feet, perhaps only a continuation of the former series of beaches. A flat plain, probably representing an old water level, occurs on top of the promontory 351 feet above the lake, and a gently rolling plain, perhaps a water level, at 396 feet. Not far to the southeast of this there is a pretty sheet of water called Mountain lake, dammed by a well defined series of beach ridges of gravel, running from 189 to 220 feet above Georgian bay. This lake, two miles long by half a mile wide, probably represents an old bay cut off by a gravel bar. On road cuttings between the Mountain lake and Meaford fine yellow stratified sand is to be seen.

At Meaford itself there are terraces rising 18 feet and 45 feet above the bay, most of the town being built on the lower level, but part on the upper one. The plain on which the railway station stands runs from 95 to 100 feet above the bay, and seems to be a water level. A somewhat duny ridge of sand stretches across it a little south of the station. Farther south a terrace at 175 feet, showing a good boulder pavement, is followed by the railway for some distance; there is however no very sharp line to be drawn between the 100 foot level and that at 175 feet.

³⁰ Bur. Mines Rep., 1898, p. 154.

³¹ Ibid, p. 152. ³² History of the Great Lakes, p. 78.

Near Field's Crossing the mountain was ascended and an excursion made to the southwest, showing several well defined terraces and a number of more doubtful ones. The rear of the lowest terrace, cut into gray shale, is 27 feet above the bay; while the rear of a second indistinct terrace is at 40; and a more distinct one with a boulder pavement stands at 158, seemingly with stages running up to 198.

Nothing suggesting a water level is seen after this till one reaches the height of 780 feet, where what appears to be a cut cliff occurs, a low escarpment of limestone rising above the slope of red and green shale. This beach must be looked on as doubtful. Somewhat higher there is a considerable extent of plain occupied by fields, and having a low cut cliff of limestone behind it. This level may be recognized across a stream valley which cuts deeply into the tableland called the mountain, and at different points heights ranging as follows were found,—815, 833, 837 and 842 feet. This plain appears to be pretty certainly an old lake level. There are possible terraces also from 869 to 909 feet, and from 968 to 990 feet above Georgian bay, but in the time at command these could not be followed out satisfactorily. The latter may correspond to the well marked terrace recorded by us at the level of 940 feet on the Blue mountains near Collingwood, about ten miles to the southeast,³³ and in that case the beach is deformed. Without working it out in the intervening region however, it is unsafe to make this statement positively.

In general one may say that more or less distinct beaches occur in the Meaford region at about 13 levels, as follows:

1 Terrace	18 to 27 feet.
2	40 to 56 "
3	63 — 82
4	95 — 100
5	158 — 175 (?)
6	189 — 220
7	351
8	396
10	815 — 842
11	869 — 882 (?)
12	896 (?) — 909 (?)
13	968 (?) — 990 (?)

Some of these water levels have been recognized at Collingwood and Owen Sound, but several do not seem to correspond to any before recorded. The highest well defined water level, 842 feet above Georgian bay or 1,422 above the sea, fits very well with several terraces mentioned by Dr. Spencer from the district to the south, e.g. near Mono Mills (1,400), west of Collingwood (1,400), west of Clarksburg (1,396), northwest of Flesherton (1,430), and south of Markdale (1,400 and 1,425).³⁴

TERRACES ON LAKE TEMISCAMING.

Another well marked series of old water levels was studied during the summer near lake Temiscaming, 200 miles north of Meaford and 280 southeast of the lofty terraces of the Michipicoton district, showing the very wide distribution of pleistocene deposits laid down in water. When the elevation of these terraces was measured lake Temiscaming was at a very low stage, so that the regular steamers could not land their passengers at the usual docks, but had to send them ashore in small boats or by an "alligator." The level of lake Temiscaming is assumed to be that of low water as determined by Mr. Barlow, 582 feet above mean sea level.

At the mouth of Montreal river a rather faintly marked low level terrace was noted at Bouin's farm, consisting of stratified sand, rising 35 feet above the lake; while a half mile up the lake it rises to 42 feet, or 624 feet above sea level. The next terrace (measured with the hand level) rises 150 feet, or 732 feet above sea, and is formed of gray stratified clay. Two other terraces occur at Bronson's farm, two miles inland; the lower at 773 feet above the sea and the higher at 811 feet, both built of stratified clay. Where it comes against the rocky ancient shore of Archaean schists the highest one has a well marked boulder pavement rising ten or fifteen feet above the plain of clay, which was probably formed at that depth below the actual water level. These clay terraces form excellent soil, as proved by the success of farming operations.

³³ Bur. Mines Report, 1898, p. 151.
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³⁴ History of the Great Lakes, p. 78.

The other terraces observed are on the Quebec shore of lake Temiscaming, near Ville Marie or Baie des Pères. Here also there is sand in the lowest terrace, or perhaps one should say in the deposits formed at high water by the present lake, and clay at the higher levels. Terraces occur at 648, 680 and 707 feet above the sea, and a series of higher ones at 736 and 791 to 796 feet, all of gray or whitish stratified clay, forming good agricultural land. These stratified clays are looked on by Barlow, following Chalmers, as probably laid down by the sea during a time of depression subsequent to the Ice Age;³⁵ but no marine fossils have been reported from them, though such fossils are common at many points in the Ottawa and St. Lawrence valleys at levels up to about 560 feet.

GLACIAL GEOLOGY.

Not much opportunity was found for the study of glacial geology proper, though more or less boulder clay, and occasionally also moraines, occur in all the districts visited. Care was taken, however, to determine the direction of glacial striae, where they were observed, and a list of them is given. The directions are magnetic, but the variation of the compass is not very great. Near lake Temagami, at the east end of the Province, it was determined roughly to be $6\frac{1}{2}^{\circ}$ toward the west. The degrees are reckoned from north towards east, south, west and north again, a much safer method of recording directions than as east or west of north, since in the latter method a mistake is easily made in writing the points of the compass, while in the method adopted the number of degrees is read directly. In a number of cases more than one direction of striation was noted

Houghton, Michigan, on diabase, 100° .

McKellar point near Cloud bay, diabase on hill top, 45° - 55° .

Current river east of Port Arthur, on slate and diabase, main striae, 90° , fainter ones, 115° .

Farther up Current river, on slate, 110° .

Goose point, Thunder bay, 70° and 110° .

Goose point, farther east on shore, 90° .

Port Arthur at railway cutting on diabase, 80° to 90° .

South of Boyer lake, Michipicoton, on hill top, 10° .

East of Boyer lake, mountain top, on soft gray green schist, 35° - 40° .

East of Eleanor lake, 30° .

Island in Loon-skin lake, 50° .

Iron locations east of Magpie lake, about 50° .

Dog river, portage past rapids below Heart mountain, well shown on schist, 20° - 25° .

Lamp portage at another point, 30° , and an older set, 350° .

Between Dog river and Paint lake, most prominent and probably oldest striae, 0° ; other sets at 340° and 20° .

Parry Sound region, Valkoughnet's farm, 35° .

Parry Sound region, Rose Point, 30° .

Parry Sound region, mouth of Seguin river, 30° .

Matabitchouan river, 3rd Portage, 25° .

Matabitchouan river, 4th Portage, 25° .

Falls east end of Rabbit lake, 10° .

Net lake, Big Dan mine, older striae, 345° ; younger set (rare), 15° .

Ville Marie, lake Temiscaming, 340° - 360° .

Ville Marie, McGregor's hotel, older, 340° , strong striae on quartzite, younger, 110° .

Near Baie des Peres, older striae, 350° - 360° ; younger, 60° .

The most striking features of the striae recorded above may be briefly referred to. The nearly east and west direction of the few striations noted on Thunder bay is surprising, since the average direction for the general region is about northeast and southwest, the ice being supposed to have advanced from the direction of Labrador; and in addition one would have expected the ice to be deflected into the course of the great depres-

³⁵ Geol. Sur. Can., 1897, p. 129 I.

sions of the region, which have about the same trend. The striae observed at McKellar Point have about the direction one would expect.

In the Michipicoton district the striae observed are in general about 45° , as might be expected, but those farther north, near Dog river, show great variations, a number trending nearly from north to south. The few striae noted near Parry Sound ran as one might expect about 30° - 35° ; but those seen in the Temiscaming region are much more variable, often presenting two sets of intersecting striae. Those on lake Temiscaming itself naturally trend in the direction of that long fiord-like depression 1,000 feet deep, which must have influenced the flow of the ice greatly. The minor striae, more or less at right angles to the course of the valley, have possibly been caused by icebergs during the depression after the retreat of the main Labradorean ice sheet. Mr. Barlow gives a considerable number of directions of striation from the region, averaging $s. 14^{\circ} w.$, but the striae from Temiscaming itself come west of north as shown in his table.³⁶

NOTES ON THE PETROGRAPHY OF ONTARIO.

During the summer of 1899 the rocks of a number of districts of Ontario were more or less carefully studied, and a considerable series of hand specimens was obtained. The more interesting of these have been studied microscopically, and will be described in the following pages, beginning with specimens from the northwest shore of lake Superior, in what may be called the Thunder bay region.

THUNDER BAY REGION.

The interesting amygdaloid rocks containing copper, in the townships of Crooks and Blake between Pigeon river and Port Arthur, were found to be too badly weathered to be worth study under the microscope, but rock obtained from the end of a drift at the latter copper deposit is quite fresh, and though evidently not in connection with the amygdaloid will be mentioned here. The rock is a rather fine grained, dark gray diabase, containing the usual lath shaped plagioclase with violet augite between, the latter partly weathered to dull green hornblende. The most interesting mineral is biotite, with pale brown and deep brown dichroism, from its appearance apparently an original constituent of the rock. Magnetite occurs in long rough rods, and many needles of apatite are embedded in the plagioclase. This rock is a characteristic example of many of the Animikie laccolitic sills.

An interesting series of rocks occurs near McKellar's point, the long promontory northeast of Pigeon point on the Minnesota side of the International boundary. As the rocks of Pigeon point have been elaborately worked out by Professor Bayley for the U. S. Geological Survey,³⁷ and those of McKellar's point resemble them greatly in the main, they scarcely need mention here. A dike on top of McKellar's point consists of medium grained diabase, with great crystals of plagioclase thickly scattered through it, probably the rock described by Bayley as porphyritic olivine gabbro; and reddish rocks like his more or less altered quartzites occur also.

An apparent laccolitic sill from Cloud bay, a mile or two north of McKellar's point, presents a rock of quite different type from any described by Bayley, and so will be treated more at length. The rock forms a flat sheet, overlying slates of the Animikie and having the same general arrangement as the laccolite sills of diabase so common in the Animikie; but its paler and somewhat reddish color immediately separates it from them. On the compact reddish gray surface many whitish or pink crystals of felspar may be seen, and also black strips of hornblende associated with them. The rock is much weathered, but in thin sections shows a groundmass consisting of spherulites, apparently of orthoclase or plagioclase, showing dimly a black cross in polarized light, and of micropegmatite between the spherules. Large, well formed crystals of plagioclase, probably oligoclase or andesine from the extinction angles, are enclosed in the ground mass, and also crystals and irregular masses of dark green hornblende, the latter sometimes separate and sometimes beside the felspars, or even embedded in them, show-

³⁶ Geol. Sur. Can., 1897, pp. 135-6 I.

³⁷ Bulletin No. 109, 1893.

ing that the hornblende was the earliest mineral to crystallize. The rock may be referred to as a granophyric porphyrite.

A number of specimens were obtained from Jarvis island near the silver mine, including slate and graywacke among sedimentary rocks, and diabase and syenite among eruptives. The relationships of these rocks are complex and hard to explain, and a red aplite, or quartz orthoclase granite, adds to the difficulty by appearing sometimes as dikes or stringers in a graywacke, and at others as seeming pebbles in the same rock. The diabases are partly of the ordinary kind, partly olivine diabase. The more acid rocks include one which may correspond to Bayley's metamorphosed quartzite; and another, which has the general appearance of syenite, green hornblende being mixed with reddish felspar, but turns out to be a granophyric, or micropegmatitic grano-diorite. It contains fairly well shaped crystals of plagioclase, and less often orthoclase surrounded by granophyre, here and there passing into considerable areas of quartz. The hornblende is red-brown when fresh, but is surrounded by green chloritic material, and sometimes almost wholly turned into it.

PARRY SOUND DISTRICT.

A few rocks from the Parry Sound district were briefly described in a previous volume of the Bureau of Mines reports,³³ but the region has received so little attention from geologists that a number of rocks collected during the past summer have been sectioned and studied, and the more interesting of them will be mentioned here. The region includes schistose, massive and sedimentary rocks, the latter however chiefly crystalline limestones. Many of the schists are clearly sheared or squeezed eruptives, but some of them may be pyroclastic, or ash rocks. The eruptives include at one end giant pegmatites, consisting of quartz and felspar crystals, alone or with muscovite and sometimes biotite; and at the other end gabbros and anorthosites. Diabase dikes, generally so common in the geologically older regions of Ontario, are here quite rare. As the rocks immediately around Parry Sound have been most carefully studied, they will be described first, and in greatest detail.

The rocks enclosing the copper deposits of the McGown mine have the look of rather basic gneisses, are dark gray, rather coarse grained and distinctly schistose; the only minerals recognizable with the lens are biotite and plagioclase. Under the microscope they are in general found to be schistose diorites or gabbros. All contain plagioclase, hornblende and biotite, and all but one or two sections also pale blue green augite and hypersthene. As much of the biotite and some of the hornblende have the confused fibrous character belonging to secondary minerals, it is probable that they have replaced augite; some of the hornblende and biotite seem to be primary however, showing as clear masses in very fresh sections. The hypersthene is trichroic, yellowish, pale green and pale red being the colors shown. Accessory minerals are numerous, including apatite prisms, sulphides and a very little micropegmatite. The felspar is almost altogether a rather basic plagioclase, having extinction angles suggesting labradorite. The rock is hypidiomorphic granular, the schistose structure being apparent only on the large scale, not under the microscope. The series should be called schistose gabbro, or gabbro gneiss.

A specimen of an entirely different kind was found associated with a gold bearing vein at this mine some years ago. It is brownish gray, fine grained, and shows much green epidote in the hand specimen. Under the microscope it proves to consist of quartz, muscovite, garnet and epidote with a little augite, titanite, magnetite and some sulphide. The muscovite is in radiating bundles, showing a black cross with polarized light. The garnet is brown red, resembling melanite somewhat. The rock is evidently greatly weathered, and how it is related to the adjacent schistose gabbro is not certain.

The schistose rock associated with the Wilcox copper mine some miles south of Parry Sound on the whole resembles that of the McGown mine, though with some variations. The most characteristic specimen consists of plagioclase, apparently labradorite or anorthite, blue green pyroxene and hypersthene with some hornblende, magnetite and apatite. The abundant hypersthene has a pleochroism of brownish yellow, brownish green and deep red brown.

³³ Bur. Mines Rep., 1894, pp. 99 and 100.

Two other phases of the country rock were collected, and may be described. One is a massive looking anorthosite, dark gray and of medium grain. The only minerals found in a thin section are anorthite and small quantities of a decomposition product representing augite. Another type is distinctly schistose and contains much red garnet and more or less quartz, as well as iron and copper pyrites, often in sufficient amounts to form an ore. The rock consists chiefly of labradorite, bluish green pyroxene, hypersthene and garnet, with smaller quantities of hornblende and biotite. This rock probably represents sheared and fractured portions of the gabbro gneiss, in whose fissures quartz and sulphides have been deposited, forming the fahlband worked for its copper ores.

Schistose anorthosite similar to that of the Wilcox mine occurs at small copper deposits on islands in Georgian bay, a few miles west; but it is here associated with a black shiny schist, showing very large cleavage surfaces of a mineral resembling hornblende. This proves under the microscope to be hypersthene with red, bluish green and brownish yellow pleochroism. It contains a few definitely oriented plates of a brown mineral like biotite, and also strips of magnetite. The other minerals are hornblende and a little plagioclase.

The schistose gabbros, etc., thus far described, form the main country rocks of the copper deposits of the region, but at Rose point and Parry Sound an interesting series of fine grained white to gray schists of an entirely different character may be found. They are very cleavable, and often bent and contorted in a most complex way. They are often porphyroidal, containing large "augen" of white felspar or black hornblende. The felspars show no twin striæ under the lens, often have curved cleavage surfaces and have rounded forms, embedded in a fine grained, white or flesh colored areole as if resulting from a crushing and rolling action undergone after the crystals were imbedded in their matrix.

The whitish and dark gray varieties of these schists are often finely interleaved with one another, and may fade into one another from point to point.

Studied with the microscope, both varieties have about the same constituents, but in varying proportions, quartz, orthoclase, biotite and hornblende, with a few garnets, and a little magnetite and calcite. Often the granular look of the particles is well marked, sometimes a dusty border separating one grain from another, but at other points the grains seem to interlock in a way suggesting a crystalline massive rock. The whole effect of these gneisses is that of sedimentary rocks, perhaps, as suggested by Dr. Elftman, ash rocks, which have been folded and metamorphosed. The large orthoclase "eyes," sometimes two inches in diameter, seem unusual constituents for a volcanic ash, but the black hornblende crystals are more characteristic of such an origin. Some of the grayer gneisses remind one of part of Lawson's Couchiching gneisses or mica schists in the Rainy Lake region. The ash-like rocks are soft and sometimes even pulverulent, and are wide spread, covering a number of square miles near the town.

At Depot harbor on Parry island, 2 or 3 miles west of Rose point, rocks of a similar kind occur, but apparently passing into more normal Laurentian gneisses. One example of the latter may be described. It is of a grayish flesh color, rather fine grained, and distinctly schistose, having lighter and darker bands. It has a somewhat granular look under the microscope, but consists generally of interlocking anhedral quartz, orthoclase and microcline, the latter mineral in largest amount. Of darker minerals there are biotite, a little blue green hornblende, titanite and magnetite.

Not far from the ash-like schist at Rose point a hill of very different rock pushes up, apparently by a fault. It is well seen in a rock cutting of the railway, and shows a bluish white ground, with many rounded patches of black and of red. At one point it shows little schistose structure, but when followed up, becomes markedly schistose. Under the microscope it is found to consist mainly of plagioclase, running from andesine to labradorite, dark green hornblende, and garnet, with a little orthoclase, or at least felspar showing no striations, muscovite, biotite and magnetite. The dark colored minerals are crowded into irregular masses, hornblende often in the middle with garnets round it, though sometimes magnetite forms the nucleus for aggregations of garnet. The rock may be called a garnetiferous diorite, though it is probable that the colored minerals are largely or wholly secondary, perhaps after augite.

Associated with the schistose rocks just mentioned are bands of crystalline limestone, white, gray or flesh colored, sometimes pure, but often charged with twisted fragments of

the schists. No sections of these rocks were studied from the neighborhood of Parry Sound, but a specimen from a point 4 miles west of Commanda, about 50 miles northeast of Parry Sound, proves interesting. It is greenish gray and coarsely crystalline, weathering yellowish brown. In thin section it reminds one of Eozoön, consisting mainly of calcite and serpentine, the latter in rounded patches, sometimes connected together, but generally separate. The serpentine contains remnants of the original mineral, generally diopside, but in some cases having parallel extinction like olivine. The latter portions may simply be diopside cut at right angles to the plane of symmetry. A number of pale blue rounded fragments of fluorite occur also.

A number of specimens were obtained from the neighborhood of Loring, south of lake Nipissing, and a few have been studied in thin sections.

A dark brownish gray, very coarse grained rock, associated with copper and nickel ores on lake Massagamashine, northeast of Loring, is gabbro, consisting of rather basic plagioclase and much weathered diolite and hypersthene, often with a margin of garnet crystals. Magnetite, hornblende and biotite are accessory minerals. This rock is commonly found with ore deposits in the region.

A gneissoid grayish white rock, streaked with black, associated with various sulphides, may be called a diorite or gabbro schist, since it consists chiefly of plagioclase feldspar running from andesine to labradorite, with some scapolite and a little augite and hornblende. A somewhat similar rock, but containing many garnets and no scapolite, occurs with a little copper ore on lot 2, concession 4 of Mills township, in the same region.

One of the most interesting rocks found near Loring is a highly graphitic schist, iron black in color, but showing lighter and darker bands. Under the microscope it is found to consist chiefly of quartz and graphite, with a little brown biotite and a very little plagioclase. It was probably at one time an impure carbonaceous sandstone, but now has the character of graphitic quartzite. It was undoubtedly a sedimentary rock in the beginning, and so may take a place with the graphitic limestones, as indicating the Upper Laurentian or Huronian age of the whole series of rocks.

RELATIONS OF UPPER AND LOWER HURONIAN IN ONTARIO.

The original Huronian area, as mapped by Logan and his assistant, Murray, lies within the Province of Ontario, which contains also its northeastern extension toward lake Temiscaming, and several other large and important tracts which have been mapped with more or less certainty as Huronian by Canadian geologists since Logan's time. As these rocks contain the most promising ore deposits of the Province, they naturally attract much attention from prospectors and geologists, and the problems connected with their formation and relationships have an economic as well as a purely scientific interest. The question as to what areas are really Huronian, and as to the relative age of the different areas mapped as Huronian, differing as they often do in striking ways from the rocks of the original region, is one requiring solution if the pre-Cambrian geology of the province is to be placed on an assured basis. During the past summer an examination of the newly discovered iron region in the Huronian district northeast of lake Superior for the Bureau of Mines has provided a set of facts which appear to throw new light on the subject.

Prospectors have followed up the Michipicoton iron range for about 60 miles, and most of this has been traversed and examined by the geologists of the Bureau of Mines, so that its character is now fairly well known. It consists as a general rule of a band of siliceous rock interleaved with thin sheets of iron ore, in many respects much like the famous iron ranges of Michigan and Minnesota. The rock has generally the aspect of a sandstone, but thin sections prove that it is not an ordinary sandstone, in spite of the fact that many parts of it crumble to fine grains under the fingers; for the grains of quartz have polygonal forms that meet in planes, but are only loosely, if at all, cemented. The grains are often six-sided, and in thick sections show a rough dodecahedral shape, the result probably of growth outward from numerous nearly equidistant centers until the grains met, just as spheres crushed together tend to take on a dodecahedral form.³⁹

³⁹ Cf. Irving and Van Hise, Penokee Iron Bearing Series, U. S. Geol. Sur., monograph xix, p. 133, et cetera, where the grains seem to be described as crystals rather than unoriented polyhedra.

The usual variety resembling sandstone sometimes passes into a rock like chert or in other cases jasper, and occasionally takes the appearance of quartzite. In many parts of the range the interbanded sandstone and magnetite or hematite are more or less brecciated, and have undoubtedly undergone great folding and crushing. The band now stands nearly vertical in most regions to which it has been followed.

This band of rock is usually thin, never more than a few hundred yards in width, and there are numerous interruptions in its outcrop, due probably to weathering, for the sandstone variety is so fragile that in river valleys it has been cut down faster than other rocks, and is often lost to sight under the thick drift deposits of the region. This probably accounts for the fact that it was overlooked until last summer, since the region is without roads and hitherto had been explored almost entirely with canoes. The cherty and jaspery varieties, however, stand weathering excellently and form ranges of hills easily followed.

It is almost certain that this band of siliceous rock charged with iron ore is of sedimentary origin, although perhaps not clastic, but rather deposited chemically.

The same association of siliceous rock and iron ore is found more than 70 miles west of Michipicoton, near Pic river, though it is not supposed that the range will be traced continuously to that point, for a tract of Laurentian is mapped as lying between. Whether these rocks should be looked on as a continuation of the Vermilion iron range north of lake Superior in western Ontario and Minnesota and of the Penokee and Marquette ranges to the south of the lake, is not certain at present. Iron miners from Minnesota consider it the same formation as the Vermilion range, and there seems no reason to doubt that it was formed under very similar conditions and shows many points of resemblance to that range.

Sandstones of the same peculiar type occur at Little Turtle lake, east of Rainy lake, and near Fort Frances on Rainy river, as well as at the Scramble gold mine near Rat Portage, on lake of the Woods. Thin sections of these rocks show the same polygonal shapes of the grains of quartz, and more or less iron ore is associated with specimens from each locality. It is very probable, then, that the same horizon exists at points far to the west of lake Superior.

Turning toward the south, jaspers and quartzitic rocks interbedded with hematite or magnetite are mentioned by Macfarlane, Bell and others as occurring a few miles north of Batchawana bay,⁴⁰ and toward the east, specimens very like the jaspery varieties of the Michipicoton iron range are found interbedded with iron ores near lakes Wahnapiatae and Temagami, between Sudbury and the Ottawa river. If, as seems probable, these jaspers are the equivalents of the western Huronian sandstones, we have a definite horizon traceable from point to point across the whole northern end of the Province, a distance of more than 600 miles. It is not suggested, of course, that these iron-bearing sandstones and jaspers will be traced for this distance as a continuous band, for the Huronian areas are separated at several points by tracts of Laurentian; nevertheless, if the conclusions just advanced are correct, we have in these rocks a most valuable thread with which to unravel the much disturbed and complicated series of Huronian rocks in Ontario.

HURONIAN CONGLOMERATES.

Less than 2 miles north of the iron-bearing sandstone of Little Gros Cap, there is a remarkable exposure of schist (or slate) conglomerate, examined many years ago at the mouth of Doré river by Sir William Logan, who evidently considered it a typical example of the Huronian, since he has described it somewhat fully in his general account of that formation.⁴¹ Among other pebbles in the conglomerate he refers to some of a chert-like stone. While studying this outcrop, which is well exposed on the wave-beaten shore at the mouth of the Doré, and also on islands to the south, the present writer found many pebbles, not only of the cherty iron-bearing rocks, but also of the pulverulent sandstones. Pebbles and boulders of all sizes, beautifully rounded and of a considerable variety of rocks—none, however, of typical Laurentian gneiss—are to be seen here in a section dipping from 70 degrees to vertically, and with a measured thickness of more than a third of a mile.⁴² The conglomerate has been traced by Professor Willmott and the writer about

⁴⁰ Geol. Sur. Can., 1866, p. 130. ⁴¹ Geol. Can., 1863, p. 54.

⁴² Ont. Bur. Mines, 1898, pp. 165-167.

17 miles from east to west, and probably extended still farther, since small outcrops of conglomerate are found in the east. Belts of conglomerate are seen also within 2 or 3 miles of other parts of the sandstone range, but no search has yet been made for pebbles of sandstone or jasper. It is evident that the Doré conglomerate marks a very important break in the Huronian of the region, and it is probable that the other conglomerates referred to are to be looked on as of the same age. The lack of Laurentian pebbles shows that they are not basal conglomerates of the Huronian resting on a Laurentian floor, and the chert and sandstone pebbles prove that they are more recent than the iron-bearing series.

A very extensive series of schist conglomerates has been mapped by Lawson on Shoal lake east of Rainy lake, and was thought by him to be a basal conglomerate of the Keewatin above the Oouchiching.⁴³ The same region has been examined by Winchell and Grant, who report that black and red jaspers occur in it as pebbles,⁴⁴ and by the present writer, who found numerous pebbles of pulverulent sandstone, as well as of cherty materials, along with the more common felsite and porphyry pebbles.⁴⁵ This conglomerate has been traced for about 15 miles from southwest to northeast, and probably has a thickness little short of a mile. That it represents a very profound break in the Keewatin series is shown by the fact that among its boulders are some of anorthosite, evidently derived from an adjoining mass of that rock. The anorthosite itself is proved to have erupted through rocks apparently belonging to the Lower Keewatin, since it carried off in its eruption fragments of chloritic and sericitic schist exactly like certain Keewatin rocks of the region. The conglomerate was formed, then, at a far later time than the underlying Keewatin schists, since they must have been solid rocks before the eruption of anorthosite, and this very coarse grained plutonic rock must have had time to cool, doubtless at a great depth, and to be deeply eroded before pebbles of it could have been rolled on a seashore and incorporated in a rock belonging to the upper part of the series.⁴⁶ This conglomerate is about three miles south of Little Turtle lake, near which iron-bearing sandstone has been found.

Lawson maps conglomerates of a similar kind on the Minnesota side of Rainy lake, where the river of the same name flows out, and mentions saccharoidal quartz pebbles as occurring in them along with various other kinds of rock.⁴⁷ He also describes a conglomerate at the west end of Schist lake, containing pebbles composed of quartz "in a very fine mosaic aggregate, partly chalcidonic."⁴⁸ Probably these pebbles are of the same character as the iron-bearing sandstone found by myself a mile east of Fort Frances, on Rainy river. Another important belt of conglomerate containing sandstone and black quartzitic pebbles occurs near Mosher bay, at the east end of the Upper Manitou lake, about 25 miles north of Shoal lake.⁴⁹ From the facts just mentioned it will be seen that conglomerates with sandstone pebbles are widely distributed in the Rainy Lake region.

Schist conglomerate also occurs at Rat Portage, a short distance southeast of the sandstone band found at the Scramble gold mine, but up to the present no pebbles of sandstone have been observed in it, though it is probably of the same age as the conglomerates of the Rainy Lake region, 80 or 100 miles to the southeast. We know, also, that jasper conglomerates form a very striking part of the quartzitic rocks of the typical Huronian, and that pebbles of jasper are met with more or less commonly in conglomerates as far east as lake Temiscaming.⁵⁰

The source of these pebbles in the typical region on the shores of lake Huron has not yet been explained, since no bands of jasper have been reported in the neighborhood. Possibly they are concealed beneath the extensive lacustrine deposits of the region, or are sunk below the waters of lake Superior or lake Huron, or the pebbles may have been derived from the ferruginous jaspers near Batchawana bay. From the widespread and abundant occurrence of these jasper pebbles we may infer a source of considerable extent. They can hardly have been obtained from the underlying Laurentian, for jasper has never been reported from the Canadian Laurentian; and since the jasper pebbles are in many cases distinctly stratified and are associated with black chert pebbles, we must suppose

⁴³ Geol. Sur. Can., 1887-'88, p. 82 F. ⁴⁴ Geol. Sur. Minn., 23rd Ann. Rep., 1894, p. 66.

⁴⁵ Ont. Bur. Mines, 1895, p. 97. ⁴⁶ Jour. Geol., vol. iv, No. 8, 1896, p. 911.

⁴⁷ Geol. Sur. Can., 1887-'88, p. 82 F. ⁴⁸ Ibid., p. 84 F.

⁴⁹ Ont. Bur. Mines, 1897, p. 123. ⁵⁰ Geol. Can., 1863, pp. 52 and 56.

them to be of sedimentary origin, and so excluded from the Laurentian, employing that term in the usual sense of a complex of ancient eruptive rocks now more or less schistose.

It is true that ferruginous chert is reported by Irving and Van Hise from the Marquette region, associated with the Kitchi schist, which they include in the Basal Complex, but those authors are of opinion that the small deposits referred to are in reality of vein formation, and therefore later in age than the schist which incloses them.⁵¹

One is tempted to ask if these cherty deposits are not more probably remnants of the Lower Huronian nipped into the Laurentian. The green Kitchi schists themselves would probably be placed by Canadian geologists in the Keewatin or Lower Huronian rather than in the Basal Complex or Laurentian.

THE MOST IMPORTANT BREAK IN THE HURONIAN.

Van Hise, the Winchells and other American geologists who have examined the typical Huronian area are of the opinion that a break occurs in the series between Logan's upper and lower slate conglomerates just above the main band of limestone, and that this is probably the equivalent of the unconformity between the upper and lower iron bearing series of Michigan and Minnesota.⁵² My own study of these rocks leads me to the conclusion that this break is not of great significance. There are pebbles of limestone in the upper slate conglomerate showing a certain interruption in the series, but the lower slate conglomerate (or graywacke conglomerate) is very like the upper one and is not appreciably more crystalline or schistose. Specimens from the basal conglomerate east of Thessalon can be perfectly matched by specimens from the upper conglomerate on Echo lake. It is much more probable that the real break is beneath the basal conglomerate near Thessalon. It is likely that some of the green schists found in the adjoining Laurentian are the equivalents of the Lower Keewatin, west of lake Superior, and so represent the Lower Huronian in the typical region.

Much stress has properly been laid on this basal conglomerate by Irving and Van Hise, and it will be well to discuss its bearing on the Huronian question.⁵³ If the lower part of the typical Huronian series corresponds to the Vermilion and other lower iron-bearing rocks of the States to the west and south of lake Superior, it should contain an equivalent for the characteristic jaspers interbedded with iron ore; but no such rock has been found by Murray in his careful work when mapping the region, nor by any later observers. On the other hand jasper pebbles are found in greater or less numbers to the very bottom of the series, a few occurring in the basal conglomerate itself.⁵⁴ If it be admitted that the large numbers of jasper pebbles, often with a banding suggesting sedimentation, are derived from a widespread sedimentary rock, then sediments must have been formed on a large scale and have been consolidated and rolled into pebbles before the basal conglomerate was laid down. It is clear that this basal conglomerate is not the lowest rock in the Algonkian, as defined by Van Hise in his excellent correlation work, nor in the Huronian, as usually defined by Canadian geologists, but that a jasper bearing Lower Algonkian or Huronian is to be looked for somewhere as a source of its pebbles, perhaps the iron range near Batchawana.

On lake Temiscaming, at the northeastern end of the same great Huronian area, another basal conglomerate has been described by Barlow and Ferrier.⁵⁵ The reasoning just given will apply to this conglomerate also, for a few months ago Mr. Archibald Blue and the writer found jasper pebbles almost at the base of the Temiscaming conglomerate. In this instance, however, as shown by Barlow in his admirable account of the geology of the region, jasper with iron ore occurring near lake Temagami provides a reasonable source of the jasper pebbles, and proves that the Lower Huronian is represented, to some extent at least, a few miles to the westward.

⁵¹ U. S. Geol. Sur., monograph xxviii, Marquette Iron Bearing Dist., pp. 186-187.

⁵² Van Hise, pre-Cambrian, p. 777; Alex. Winchell, Bull. Geol. Soc. Am., vol. iv, 1893, p. 344, and Am. Jour. Sci., vol. xlii, p. 317.

⁵³ Cf. Ont. Bur. Mines, 1899, p. 160, et cetera. ⁵⁴ Ibid., p. 162.

⁵⁵ On the Relations and Structure of certain Granites and associated Arkose on Lake Temiscaming. British Assoc., Toronto, 1897; also see Geol. Sur. Can., vol. x, I, pp. 195-9.

CONCLUSIONS.

Granting that the ferriferous sandstones, cherts and jaspers described above belong to a definite horizon near the top of the Lower Huronian (or Algonkian), and that the conglomerates often found near by containing sandstone, chert or jasper pebbles represent also a definite horizon as basal conglomerates of the Upper Huronian, some interesting conclusions follow.

In the first place, the gap between the Upper and Lower Huronian is shown to be a very profound one. Basal conglomerates often thousands of feet thick, and found from point to point over a distance of more than 600 miles, indicate an erosive period of great extent and significance. In the next place, we have in these widespread rocks a means of correlating the often widely separated and very different looking rocks mapped as Huronian in Ontario. Doctor Lawson, in defining his Keewatin on the Lake of the Woods and Rainy lake, came to the conclusion that the highly metamorphosed schists and eruptives of that region stood lower in the geological scale than the less altered quartzites, et cetera, of the typical Huronian as described by Logan. If the ground taken in this paper is correct, viz., that the Shoal Lake conglomerate is at the base of the Upper Huronian and the ferriferous sandstones found at some points in the region belong to the Lower Huronian, it is evident that at least a part of the Keewatin is of Huronian age. Whether the great beds of schist formed of pyroclastic materials and sheared eruptives mapped by Doctor Lawson are older than the Lower Huronian, and so should retain the name Keewatin as a separate formation, need not be discussed here.

The resemblance between the iron-bearing rocks shown to exist in Ontario and the upper and lower iron-bearing series so carefully worked out in Minnesota and Michigan suggests that they are of the same age, and that the break between the Upper and Lower Huronian extends along the south side of lake Superior as well as the north, though it is too soon to state positively that this is the case. The detailed mapping of the Vermilion series of Minnesota to the boundary of Ontario, which Professor Van Hise informs me is about complete, will give an opportunity to trace with more certainty the relations of these two great areas of pre-Cambrian rock.

HERONITE, OR ANALCITE-TINGUAITE.

Owing to the interest connected with the rock from near Heron Bay on lake Superior, described in last year's report as heronite,⁵⁶ another visit was made to the locality in order to trace out the relationships of the eruptives of the region. The outcrop of the dike from which the original specimens were obtained was visited again in a cutting on the Canadian Pacific Railway east of mile 804. It was found, however, that the outcrop, which is several feet wide, could not be followed to any distance, nor could its boundaries be clearly seen owing to drift and the debris from the cutting. Another outcrop of similar rock was found between miles 804 and 5, a dike irregular in width, but several feet wide, and with a strike of about 120°. It is darker than the rock from the original locality, and shows few of the concretionary or spherulitic spots so characteristic of it. There also the boundaries are not easily followed, but on one side it touches a dark gray diabase dike and grows finer grained as it approaches the latter rock, evidently being later than the diabase, which is probably of the age of the Keeweenaw eruptions.

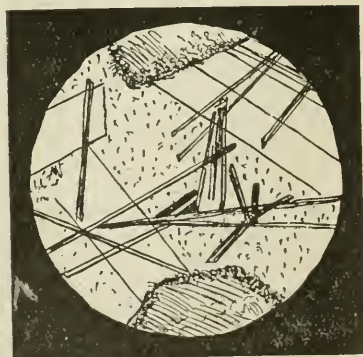
In another cutting, three-fourths of a mile west of the last and west of mile 805, several large and small dikes of rock in general resembling heronite occur, and as these were better exposed than the former outcrops they were studied with some care. Four main dikes show in the cutting from ten inches to six feet in width, running parallel to one another, with a strike of 110°. They can be followed a quarter of a mile to the west, and two or three hundred yards toward the east over rocky, partly wooded hills. The pitted surface, where small spherules have weathered out, gives an easy means of recognizing the dikes, which grow finer grained toward the edge, and seem glassy at the contact with the dark gray Huronian slate they penetrate. Small stringers from the dikes run off into the slate, and fragments of the latter are sometimes enclosed by them, their edges being often somewhat rounded.

⁵⁶ Bur. Mines Rep., 1898, pp. 172 and 3.

The texture of these dike rocks is very variable, since they are sometimes filled with small or large concretionary masses; sometimes entirely free from them; sometimes glassy in appearance; at others crystalline looking, with a moderately coarse grain. The largest dike has also the largest concretions, sometimes reaching a width of two inches. The rock as a whole is reddish brown to purplish gray, the spherules being darker in color than the matrix.

Specimens of all types of those rocks were taken and have been studied microscopically. Unfortunately most of them have proved to be very badly weathered. In all that were not too much decomposed, feldspars, aegyrine and more or less analcite, with brown iron oxide as a secondary mineral, were to be seen; and in a number there were also evidences of nepheline crystals, now changed to an aggregate of secondary minerals.

When the rock named heronite in last year's report was studied by the writer, he had no access to examples of the rare rock named tinguaitite by Rosenbusch, and the description of that rock suggested no special relationship to the specimen from Heron Bay.⁵⁷ Since then specimens of tinguaitite from various localities have been secured through the kindness of Dr. H. S. Washington and of Professor Pirsson of Yale, and the latter gentleman has given aid in looking up the literature of the subject, so that there has been an opportunity to study the rock and its relationships more thoroughly. Without doubt the rock described as heronite is closely related to the group of tinguaites, which are dike rocks associated with nepheline syenites, though the large amount of analcite and the absence of nepheline seem to separate it from them. An analcite tinguaitite described by Dr. Washington⁵⁸ comes very close to it however, though it contains 4 per cent more silica and 1.67 less water, the latter indicating a smaller percentage of analcite; which in the rock from Heron Bay reached nearly 50 per cent.



Heronite : Analcite dotted.

Some of the freshest rocks from the new dikes found last summer approach more closely to the tinguaites, since they contain large numbers of crystals of nepheline, now however entirely turned to secondary minerals in the sections studied, and should perhaps be put into that group, the main differences being the large amount of analcite contained by them and the very low percentage of silica. Two of the least weathered specimens were analyzed and will be described with more detail.

The first was from a dike about a mile west of the original locality for heronite between miles 804 and 805 on the railway. The rock is rather dark purplish gray and very fine grained with a few whitish spots, suggesting a porphyritic structure. Thin sections

⁵⁷ Mikroskopische Physiographie, band ii, pp. 472-488.

⁵⁸ Am. Jour. Sc., vol. vi, 4th Series, 1898, 182, etc.

show many oblong and six sided areas of turbid material, having brownish rims from the presence of limonite, with what looks like a clear glassy ground between, the latter penetrated in all directions by fresh looking green needles of aegyrte. Between crossed nicols it is found that the turbid areas representing nepheline show aggregate polarization, and rarely have any suggestion of parallel extinction. The transparent areas prove to consist mainly of plates of feldspar, probably orthoclase, and of analcite. With the selenite plate it is found that very much of the clear material is doubly refractive, though considerable areas show no change of color. The feldspar is often fairly fresh looking and not turbid; and the analcite which fills spaces between the crystals is sometimes fresh and clear also, though more often turbid. Polysynthetic twinning, suggesting plagioclase, was observed but seldom. The only other important mineral is aegyrte, whose green rods and needles penetrate both feldspar and analcite impartially, but not the phenocrysts of nepheline, the latter apparently having been the first mineral to crystallize or else having crowded the aegyrte aside, while the analcite came last of all. Since the delicate aegyrte needles run undisturbed from the feldspar into the analcite, the latter was almost certainly an original constituent of the rock; but it is probable that part of the aggregate, formed by the weathering of nepheline, consists of analcite also and therefore is of secondary origin. Much of the aggregate having the form of nepheline crystals is doubly refracting, but part shows no change of color when rotated with the selenite plate. To determine the amount of analcite present a partial analysis was made by myself, the powdered rock being treated with HCl and reduced to dryness to render gelatinous silica insoluble. The amount dissolved was 32.50 per cent., and its composition is as follows:

Al ₂ O ₃	11.90
Fe ₂ O ₃	3.71
CaO	2.06
Na ₂ O	7.08
H ₂ O (at red heat)	4.65
H ₂ O (at 100°) .....	.45
CO ₂	2.65
Total	32.50

If the CaO, CO₂, Fe₂O₃ and .67 per cent of H₂O necessary to form limonite with the sesquioxide of iron present are removed, we have Al₂O₃ 11.90, Na₂O 7.08, and H₂O 3.98, with the ratios of Al₂O₃ .117, Na₂O .114 and H₂O .256, which correspond to the composition of analcite. If an appropriate percentage of SiO₂ is assumed to be combined with these elements, 27.96, the whole percentage of analcite present in the rock is 50.92. If the potash found in the complete analysis (I) is referred to orthoclase, and equivalent amounts of alumina and silica taken as combined with it, the whole percentage of orthoclase is 27.87. The analcite and orthoclase together appear to make up about 78 per cent of the whole rock, leaving only 22 per cent for aegyrte and the secondary minerals.

A second specimen taken from the same locality shows considerable differences from the one just described. The weathered nephelines are much the same, but many of the feldspars are lath shaped, resembling plagioclase, and are so arranged as to hint at the diabase structure, the long strips enclosing angular spaces in which the nepheline and aegyrte are crowded. The broader feldspars are transfixed by the aegyrte needles, but the lath shaped ones are rot. In this specimen both nepheline and plagioclase preceded the aegyrte, and probably the plagioclase came first. No analysis was made of this specimen, so that its chemical composition cannot be compared with that of the first. A third specimen is badly weathered, but in general resembles the second under the microscope.

A number of sections from various phases of the third group of dikes beyond mile 805 were examined, but most of them are too seriously weathered to be satisfactorily studied, especially those showing large concretionary or spherulitic structures. Some of the finest grained, almost glassy looking pieces from the margin of dikes, are greener than the rest of the specimens, and under the microscope are found to consist of an aggregate of products of weathering, containing many small stout prisms of green aegyrte. Other parts contain quite perfect spherulites of orthoclase, showing a black cross in polarized light. No unchanged glass is to be distinguished.

The freshest specimen examined is mottled dark green and red, and on a weathered surface is pitted as if amygdaloidal. The weathered crust is greenish gray to brown, not white as found by Rosenbusch for tinguaites. Thin sections show mainly orthoclase,

pierced by a network of aegyrte needles and some brownish cloudy areas containing much limonite. Distinct outlines of weathered nepheline may be seen, but are much less numerous than in sections previously described from the dike a mile to the east. Not many areas of isotropic material are found, and few lath shaped feldspars, but the orthoclases are apt to be plate like and to show a radial arrangement. A complete analysis of this rock has been made by Mr. A. H. A. Robinson, fellow in chemistry of the School of Science, and is given in the table of analyses. A partial analysis of the materials dissolved by hydrochloric acid made by myself is given below :

Al ₂ O ₃	12.72
Fe ₂ O ₃	1.22
Ca O	1.01
Na ₂ O	7.25
H ₂ O (at red heat)	4.83
H ₂ O (at 100°) .....	.47
CO ₂ .....	.26
	27.76

The constituents of analcite reckoned from this give a surprisingly large amount, 54.46 per cent, since not much of this mineral can be seen in the thin sections, and it may be that the portion taken for analysis differs from that studied with the microscope. From the complete analysis the total amount of orthoclase may be reckoned at 32.30 per cent.

The following table of analyses includes the one of heronite published last year, the analysis of rock from the dike between miles 804 and 805, and the analysis of the last mentioned rock from a dike west of mile 805, also several analyses of tinguaites for comparison.

—	I	II	III	IV	V	VI	VII	VIII
Si O ₂	52.73	48.07	52.03	53.21	52.91	56.75	57.63	54.46
Ti O ₂ .....				.35		.30	.23	trace
Al ₂ O ₃	20.05	18.36	20.58	22.02	19.49	20.69	17.53	19.96
Fe ₂ O ₃	3.43	3.95	3.40		4.78	3.52	3.46	2.34
Fe O .....	.99	3.39	1.98	4.18	2.05	.59	1.18	3.33
Mn O .....		.55	.13	.42	.44	trace	trace	trace
Mg O .....	.17	.32	.27	.91	.29	.11	.22	.61
Ca O	3.35	3.76	2.46	1.33	2.47	.37	1.35	2.12
Sr O .....					.09			
Ba O .....	.11							
Na ₂ O	7.94	8.72	8.63	10.37	7.13	11.45	5.80	8.68
K ₂ O	4.77	4.71	5.46	6.41	7.88	2.90	9.16	2.76
H ₂ O (at red heat) ..	4.85	4.65	4.83	.81	1.19	3.18	3.22	5.20
H ₂ O (at 100°) .....	.69	.45	.47			.04		
P ₂ O ₅	trace	.14	.07		trace		trace	
CO ₂ .....	.93	2.65	.26					
Cl .....					.53	.28	.08	
Fl .....					.48			
SO ₂ .....					.52			
Total	100.01	99.72	100.57	100.01	100.25	100.28	99.86	99.46
Spec. Grav	2.466	2.60	2.55					

I. Heronite, Heron Bay, Ont., H. W. Charlton analyst, Bur. Mines, 1899, p. 173.

II. Dike between miles 804 and 5, Heron Bay, A. H. A. Robinson. anal.

III. Dike west of mile 805, Heron Bay, A. H. A. Robinson anal.

IV. Tinguaitite porphyry from Foia, v. Kraatz-Koschlamn. Hackman, Mineralogische Mittheilungen, XVI, 1896, p. 257.

V. Leucite-tinguaitite, Magnet Cove, Ark., J. F. Williams, Ig. Rocks, Arkansas, 1890, p. 287.

VI. Analcite-tinguaitite, Pickard's Point, H. S. Washington anal., Am. Jour. Sc. (4) 1898, p. 185.

VII. Tinguaitite-porphry, Cone Butte, Judith Mts., Montana; L. V. Pirsson anal., Weed and Pirsson, Bear-paw Mts., Am. Jour. Sc., (4) vol. ii, 1896, p. 192.

VIII. Tinguaitite, Umphek, Kola; K. Kjellin, anal., Feunia ii, No. 2, 1894, p. 158.

CHENG A partial analysis of a dark red specimen from a large dike west of mile 805, made by Mr. G. G. Nasmith in the chemical laboratory of Toronto University, showed that some specimens from this group of dikes are more basic than the one whose composition

is given in II. The silica is 47.45, alumina 20.13 and the sesquioxide of iron (monoxide included) 4.78. Including this partial analysis, it will be seen that the new dikes are somewhat less acid than the one from which the rock named heronite was taken last year, and that all of the analyses show less silica than any tinguaite reported, though the percentage of silica in the leucite-tinguaite from Magnet Cove comes very close to that of heronite. In fact as far as chemical composition is concerned one might start from the biotite-tinguaite described by Eakle from Massachusetts, with 60.05 per cent. Si O_2 ,⁵⁹ and find all intervening degrees of acidity down to the red dike rock from beyond mile 805 with 47.45 Si O_2 . In other respects the analyses given are on the whole much alike, except for certain variations in the relative amounts of potash and soda and large variations in the amount of water contained. It is very interesting to see that this group of rocks continues the series so well described by Washington in his paper on the Petrographical Province of Essex County, Mass.,⁶⁰ starting with paisanite having 76.49 or less silica, passing on to sölvsergites having 60 to 65 per cent., then to tinguaite running from 53 to 60 per cent., followed by the Heron Bay dike rocks having from 47.45 to 52.73 per cent. of silica. The lowest percentage of silica comes not far from that of the analcite-basalt described by Whitman Cross from Colorado, which has 45.59 per cent; but in other respects the analyses of the two rocks are very different.⁶¹ The rock nearest in composition to the Heron Bay rocks seems to be the tinguaite from Umptek, which has the same percentage of water, a little less potash and about 2 per cent. more silica. I am unfortunately not within reach of the paper in which this rock was originally described. Rosenbusch's description makes it consist of a web of aegyrte, strips of sanidine and albite with sharply idiomorphic nepheline and pseudomorphs of analcite after nepheline and leucite (?).⁶²

There are no apparent pseudomorphs of analcite after leucite in the Heron bay rocks, so that they were probably never leucite-tinguaite. On the other hand, all of them which are fresh enough for satisfactory study appear to contain original analcite, for the delicate needles of aegyrte cross from analcite to orthoclase without break or change of character, which would hardly be possible if the analcite is secondary after nepheline. The formation of analcite from the latter mineral implies hydration and considerable expansion, which must have had some effect on the slender prisms of aegyrte. It is probable, however, that in the dike rocks of the region containing aggregates having the form of nepheline, part of the analcite has been formed from nepheline, replacing it; so that secondary analcite exists in this case.

Among the thin sections made from material provided by the kindness of Dr. Washington and Prof. Pirsson, the one which approaches nearest to the rocks described in this paper as coming from a dike between miles 804 and 5, is from Stolpas, Alnoe, Sweden, collected by Hogboem. It is crowded with small crystals of nepheline, generally more or less changed to other minerals, probably zeolites, but not analcite so far as can be determined.

The nearest examples to the rock described as heronite are from Elk peak and Big Grassy peak in the Judith mountains, but neither is closely like the rock from Heron Bay in thin section, since no analcite is to be found, nor is there any marked tendency to a radiate arrangement of the aegyrte needles or the feldspars.

From what has been said above, it will be seen how closely the Heron Bay rocks approach the tinguaite, the only important chemical differences being the large amount of combined water present, 4.65 to 4.85 per cent., and the low silica, from 47.45 to 52.73 per cent.; while the main differences observable with the microscope are the tendency to spherulitic structure and the large amount of analcite present. Hitherto, so far as I am aware, analcite has never been recognized as an original constituent of tinguaite, except by Washington in the case of the rock from Pickard's point,⁶³ but as a secondary mineral it is rather often mentioned. Judging from the analysis of the tinguaite from Umptek with 5.20 per cent. of water, it appears to contain about as much analcite as the Heron Bay rocks (which have from 5.10 to 5.54 per cent. of total water); but in this case the analcite is stated to be secondary after nepheline and leucite.

⁵⁹ Am. Jour. Sc., (4) vol. vi, 1898, p. 491.

⁶⁰ Jour. Geol., vol. vii, No. 2, 1899, pp. 113 to 121.

⁶¹ Jour. Geol., vol. v, No. 7, 1897, p. 689.

⁶² Inikrosk. Phys., band ii, p. 484.

⁶³ Jour. Geol., vol. vii, No. 2, 1899, p. 119.

The fact that the rocks from Heron Bay are usually dark red or brown in color depends of course on the amount of secondary iron oxides present, which, though not very large in percentage, are so diffused as to hide the green of the fresh looking aegyrite. If this oxide were removed the rocks would probably have the characteristic green of the tinguaite. If the name heronite had not already been introduced for dike rocks formed essentially of analcite, orthoclase and aegyrite, it might have been as well to call these interesting rocks analcite tinguaite; but the mineralogical differences between them and the ordinary tinguaite seem sufficient to make a new name justifiable.

MINERALS OF ONTARIO, WITH NOTES

By Willet G. Miller

In the following list an attempt has been made to give some of the more important localities in which the minerals of Ontario are known to occur. In the case of the most common minerals only a few of the places in which they occur are mentioned. As many of these minerals are found in innumerable localities, it was thought best to name only a few places in which good specimens have been obtained, if they are only of scientific value, and in the case of common ores the localities given are chiefly those in which the minerals have either been mined or where the deposits appear to be of some economic value. In the case of some of the rarer minerals and ores, all the known localities are given.

In the descriptions of some of the localities it seemed best to quote from the writers who first described the occurrences, or from authorities who have dealt with the occurrence of certain minerals of the Province. In many cases where the occurrences have been pretty fully described by other writers, reference is made to the literature in which the descriptions are given. The minerals and metals are arranged in alphabetical order.

A map prepared by Mr. J. W. Evans accompanies the notes on the localities of nickel. It is now nearly ten years since Dr. Robert Bell's paper and map on the Sudbury deposits was published in the first report of the Bureau, and as many deposits have been discovered since that time it seemed advisable to bring the map more up to date. On the suggestion being made to Mr. Evans, who is well acquainted with the Sudbury district, he agreed to prepare a map.

The list of localities has been taken chiefly from the Reports of the Geological Survey of Canada and from the Reports of the Bureau of mines, and in referring to these reports use is made of the following contractions:

- B. M. = Report of the Bureau of Mines, Ontario, 1891 to 1898.
G. C. = Geology of Canada, 1863.
G. S. C. = Report of the Geological Survey of Canada from 1841 to 1899.
R. Com. = Royal Commission on the Mineral Resources of Ontario, 1890.

In referring to lots and concessions or ranges, the Arabic numbers, 1, 2, 3, etc., are used to indicate the former, and Roman numerals, I, II, III, etc, the latter. Thus, 7 IX means that the mineral to which reference is made is found on the seventh lot in the ninth concession or range. The names given for localities are chiefly those of townships.

ACTINOLITE. Frequently occurs in association with Laurentian limestones. The following are some of the localities in which specimens of the mineral have been obtained which are referred to in reports of the Geological Survey and other publications: Clarendon 36 VI; Dalhousie¹; Elzevir 7 II, 4 VII; Grimsthorpe 8, 9, 10 V; Hungerford II; Kalaár 7 I, 12, 13 I²; Westmeath.³

SiO ₂	56.70	K ₂ O	0.24
Al ₂ O ₃	1.62	Na ₂ O	0.64
Fe ₂ O ₃	3.06	H ₂ O at 100° C	0.64
FeO	7.19	H ₂ O above 100° C	2.05
MnO	0.30		
NiO	0.54		100 80
CaO	10.62	Sp. gr. at 15° C	2.941
MgO	17.20		

¹ G.S.C. 1898, p. 51 R.

² B.M. 1893, pp. 89-102.

³ G.S.C. 1892-3, p. 15 R.

ADAMANTINE SPAR. See Corundum.

ÆGIRINE. Heron bay, in an analcite rock, and in other rocks of the Province.
B. M. 1898, pp. 172-3.

AGALMATOLITE. "Under different forms occurs both in the Laurentian and Silurian series, and sometimes forms rock masses among them."
G. C. p. 482.

AGATE. "Agates are found along the entire coast of lake Superior in great abundance, and often of considerable size and beauty. The finest in this region, however, are derived from the trap of Michipicoton island. They also occur on St. Ignace and Simpson's islands, on the former only as nodules in the trap. Both chalcedony and agate occur also as veins, filling dis-

locations and cracks which penetrate the trap in several directions. In the Thunder bay district they are associated with amethysts, occurring also as pebbles. Although these agates are often of rich color and are beautifully veined, they are rarely over two inches across. Many are sold to tourists as ornaments, and many others could probably be disposed of if a little more attention were given to cutting and polishing them. As natural agates their color is exceptionally fine. Nearly all the large agates sold in this region are foreign material, as well as of foreign coloring and cutting."

G. F. Kunz in G. S. C. 1887-8, p. 71 S.

ALBITE. Occurs as a constituent of certain granites and syenites. The mineral is also found in certain apatite deposits and elsewhere. Bromley; Rathwell's lot, North Burgess; Ross 5 l. See also peristirite.

ALLANITE. Dalton 25 XII; Galway; Hagarty; Hollow lake, Muskoka river.

Can. Journal, vol. ix, p. 103.

ALMANDINE. This mineral is a constituent of many of the metamorphic rocks of the Province. See garnet.

ALUM. See kalinite.

ALUMINIUM ORE. See corundum.

AMAZONITE. Cameron 6 A, 7 B; Lyndoch 13 XV¹; Sebastopol 31 X.

¹ B. M. 1897, pp 234-7.

AMETHYST. "Amethyst is found in some form in nearly every vein cutting the cherty and argillaceous slates around Thunder bay on the north shore of lake Superior. At Amethyst harbor this mineral constitutes almost the entire vein, and numerous openings have been made to obtain it for tourists who visit the spot. Thousands of dollars worth are annually sold here, and as much more is sent to Niagara Falls, Pike's Peak, Hot Springs, and other tourists' resorts, as well as to the mineral dealers. Surfaces several feet across are often covered with crystals from $\frac{1}{4}$ inch to 5 inches long, rich in color, and having a high polish; sometimes, especially when large, the crystals have a coating of a rusty brown color, owing to the oxidation of the included goethite. This is one of the most famous occurrences of this mineral, regarded as mineral specimens, but the purple color is very unevenly distributed, resembling the Siberian not the Brazilian in this respect, and as the crystals are not transparent like those of Siberia they afford very few gem stones of value."

G. F. Kunz in G. S. C. 1887-8, p. 69 S.

AMIANTHUS. See asbestos.

AMPHIBOLE. See hornblende, actinolite, tremolite and raphilite.

ANALCITE. In amygdaloidal trap of lake Superior Michipicoton island, with native copper. Heron Bay, lake Superior.

B. M. 1898, pp. 172-3.

ANDALUSITE. Has been reported from a few places, but no well defined specimens of the mineral have been described.

ANDESINE. A constituent of different rocks. North Sherbrooke 16 III, a felspar from "a coarse grained diorite consisting of dark hornblende and a white felspar" has the following composition, which shows it should be placed under andesine but near labradorite.

SiO ₂	54.186	K ₂ O	1.397
Al ₂ O ₃	27.508	H ₂ O	1.121
F ₂ O ₃	0.454		
MgO	0.777		100.868
CaO	9.386	Sp. gr	2.697
Na ₂ O	6.039		

G. S. C. 1876-7, p. 316.

ANDRADITE. Tudor, Emily mine. Dungannon, titaniferous in nepheline syenite.

SiO ₂	36.604	CaO	29.306
TiO ₂	1.078	MgO	1.384
Al ₂ O ₃	9.771	Ignition	0.285
Fe ₂ O ₃	15.996		
FeO	3.852		99.577
MnO	1.301	Sp. gr. at 16° C	3.739

Am. Jr. Science, March, 1896.

ANHYDRITE.—Frontenac county, Foxton and Boyd Smith mines in the Laurentain.¹ North Burgess, 4 III. Niagara formation, in cavities and geodes with barite, celestine, etc.

¹ Can. Rec. Science, 1894.

ANIMIKITE. Silver Islet.

Am. Jr. Science, vol. xvii, 1879, p. 466.

ANNABERGITE. Silver Islet.

ANORTHITE. Occurs as a constituent of some igneous rocks.

ANORTHOCLASE. Appears to be a constituent of some of the acidic rocks and those high in the alkalis.

ANTHOLITE. Elzevir 7, 8 XI.

Am. Jr. Science, vol. xlviii, p. 281 and B. M. 1893, p. 98.

ANTHRAXOLITE. A general name proposed by Prof. E. J. Chapman for the pre-carboniferous coal-like materials which occur in different parts of the Province. Under the microscope it shows no trace of vegetable origin, and it occurs in veins and under other conditions which show that it is in all probability an alteration product of petroleum or asphalt. It is sometimes found in the interior of orthoceratites and other fossil shells. A variety from Thunder bay which occurs in regularly banded veins with quartz and iron pyrites had a specific gravity of 1.43 and showed the following composition: Moisture 2.08, additional loss in closed vessel 3.56, ash 0.00, fixed carbon by difference 94.36.¹

The substance is also found in the Kingston district. In one case crystals of barite and other minerals which occur in a vein in Silurian limestone are coated with the material, showing that it is of more recent origin than the crystals and must originally have been in the fluid state. An analysis of this material gave C. 90.25, H. 4.16, N. 0.52, S. 0.66, ash 0.72, O. 3.69, moisture 0.96 and sp. gr. 1.365.

A substance of similar origin to those referred to occurs in the Sudbury district, Balfour 10 I, etc., and has attracted considerable attention as being a possible source of fuel. It was found by Mr. G. R. Mickle to have the composition of anthracite—C. 94.92, H. 0.52, N. 1.04, S. 0.31, ash 1.52, O. 1.69, moisture 2.48, sp. gr. 1.865.²

¹Can. Journal, vol. x, p. 411. ²Trans. Can. Inst., April 27th, 1897. B. M. 1896, pp. 159 to 166.

ANTIMONY. See stibnite.

ANTIMONIAL SILVER. Silver Islet.

APATITE. Apatite is found in Canada in greater quantity and in finer crystals than in any other country. The crystals are often of great size and perfection. Magnificent crystals of several feet in length and of fine color are found throughout eastern Ontario in the Grenville series of the Laurentian, at lake Clear and elsewhere. See under sphene.

According to Dr. T. S. Hunt nodules composed in great part of phosphate of lime occur at many localities in the Lower Silurian rocks. The mineral also occurs in microscopic crystals as a minor accessory constituent in various igneous and other rocks.

Since the discovery of the lower grade but more cheaply mined "phosphate" in the south of the United States activity in the mining of apatite for use in fertilizers has ceased in Ontario, although some of the mineral has been produced as a by-product in mica mining and a little of the material has been mined for use in blast furnace work.

It has been stated recently that some apatite is being used in the Province of Quebec in the production of phosphorus by an electrolytic process. Apatite being purer than the southern phosphates is better adapted to this purpose, and it is possible that in time it will come to be used quite extensively for the extraction of the element phosphorous. The following are a few of the important localities in which the mineral has been found in this Province: Bedford 29, 30 I; Cardiff 22 XIV; Dudley 4 III; Dysart 11 V; Faraday; Harcourt 21 XI; Hinchinbrooke 29, 30 I; Loughborough 13 X; Monmouth, 6 X, 14, 15, 17 XI; Montegale 26 VI; North Burgess 4, 5, 6, 7, 8, 9, 10 V, 10, 11, 13 VI, 5, 6, 7, 8 VII, 2, 4, 5, 6, 7 VIII, 5 IX; North Crosby; North Elmsley 24, 25, 26, VIII; Oso 6 I; Ross 7 I, 13 VI; Sebastopol 31 XI, 23 XII; Storrington 2, 4, 5 XIV.

The chief phosphate district of Ontario may be said to be in the form of a belt which crosses the counties of Leeds, Lanark, Frontenac, Addington and Renfrew. Its length is about 100 miles, and its average breadth is over 50 miles.

The literature on the apatites of Ontario is very extensive. Many of the reports of the Geological Survey deal with the subject, as do also the reports of the Bureau of Mines. The phosphate industry is also treated of in the report on the Mineral Resources of Ontario, 1890, pp. 436 to 443 and 167 to 180.

APOPHYLLITE. "in foliated masses or plates, often of a red color, associated with calcite in Prince's vein on Spar island, lake Superior."

G. C. p. 482.

ARRAGONITE. This mineral occurs associated occasionally with some of the fossilized organic remains in the Paleozoic strata and under other conditions. "Fibrous arragonite appears to occur sparingly amongst the lake Superior traps; and occasionally in stalactitic coatings on the sides of cracks in some of our limestone rocks . . ."

G. C. p. 125. Chapman, Min. and Geol. p. 125.

ARGENTITE. Is found in a number of deposits in the Port Arthur district, among which are the following: Lybster, Silver Mountain mine; O'Connor, Beaver mine; Papinooonge, Rabbit Mountain mine; Silver Islet.¹

Wither's Mine, Thunder Bay.²

S	13.87
Ag	86.44
Cu	trace
	99.81
Sp. gr	7.31

¹ See G. S. C. 1887, vol. iii, pp. 7 to 131 H for an account of silver and other mining operations on lake Superior. ² Chapman Min. and Geol. p. 67.

ARSENIC. Edwards island, lake Superior (native). For arsenic-holding minerals see mispickel, erythrite and domeykite.

ARSENIC BLOOM. See arsenolite.

ARSENOLITE. On mispickel, Marmora and elsewhere, e. g., mining location WR3 in township 40 s. e. side of lake Wahnapiitæ.

ARSENOPYRITE. See Mispickel.

ASBESTUS. Island s. e. of Rendezvous point, Long bay, Lake of the Woods. Blythfield near Calabogie lake; Elzevir 7 XI; Marmora; Sebastopol 32 XI (serpentinous); Ross 8 IX (serpentinous); North Burgess (serpentinous)¹; O'Connor, Beaver mine.

¹ G. S. C. 1882-3-4 p. 14 L.

ASPHALTUM. Has been observed in small quantities in the limestone of the Corniferous and other formations. The so called "gum beds" or mineral tar deposits of Enniskillen may be placed under this heading.

AUGITE. A not uncommon constituent of igneous rocks, such as the Sudbury diabase. See under pyroxene for other localities.

AVENTURINE FELSPAR. "Sunstone or aventurine felspar has been described by Dr. Bigsby in the form of a largely crystallized flesh-red felspar, constituting part of a granitic vein traversing gneiss, 20 miles east of the French river, on the northeast shore of lake Huron, and occurs in fine specimens in Sebastopol."

G. S. C. 1887-8 p. 75 S.

AXINITE. "The rare species axinite is said by Dr. Bigsby to have been found in fine crystals, lining a cavity in a boulder of primitive rock at Hawkesbury."

G. C. p. 493.

AZURITE. Killaly's location, lake Huron; Batchewana bay and Prince's location, lake Superior, and at other localities in small quantities associated with malachite.

BARITE. "The most abundant source of barytes in Canada will, however, be found in the veinstones of the large bodies carrying copper ores on the north shore of lake Superior, between Pigeon river and Fort William and in Thunder bay."¹ Deposits of the mineral have been worked to some extent in Frontenac county. Bathurst 4 VI; Dummer; Galway; Lansdowne 2 VII; Levant 22 I; Madoc 15 VI; Methuen; McNab; McKellar's Island; North Burgess 4 IX; Dog lake, Storrington; Ramsay IV.

¹ G. C. p. 771.

BARYTOCELESTITE. The celestite which occurs in the vicinity of Kingston city contains some barium.

BERYL. Calvin¹; Lyndoch 13 XV²; Seine bay, Rainy lake, according to Dr. Bigsby.

¹ G. S. C. p. 14 R, 1896.

² B. M. pp. 243-7, 1897.

BIOTITE. In addition to being a constituent of many rocks in the form of small flakes and grains, this mineral occurs quite frequently in masses of considerable size. Dungannon; Herschel; Montegale 24, 25 VI; Ross 13 VI; Sebastopol 32 XII; Hyman 6 I, chromiferous biotite.

BISMITE. Lyndoch.

G. S. C. 1895, p. 14 R.

BISMUTH. Native in Tudor, and in rolled pieces of quartz near Echo lake, north of lake Huron. See also bismite and bismuthinite.

BISMUTHINITE. Barrie¹; Lyndoch²; Mikado mine, Rainy River district; Tudor 34 III.³

¹ B. M. p. 234, 1897.

² G. S. C. p. 14 R, 1895.

³ G. S. C. p. 9 L. 1883.

BITUMEN. Occurs in the Utica shales and in limestones of different Palæozoic formations. Bituminous shales, or pyroschists, are described on pages 523, 622, 627 and 728 of the Geology of Canada, 1863. See also petroleum.

BLACK JACK. See sphalerite.

BLUEITE. See under whartonite.

BOG IRON ORE. See limonite.

BOG MANGANESE. See wad.

BORNITE. Bruce Mines; Mamainse; Parry Sound; Point-aux-Mines.

BOURNONITE. Bagot 14 XII; Darling 22 III.

BYTOWNITE. A constituent of igneous rocks in various localities. Bathurst; South Sherbrooke.¹ See also Dr. T. Sterry Hunt's analysis²

¹ B. M. pp. 226-8, 1898.

² G. C. p. 79.

CACOXENITE. Elizabethtown 19 II.

G. S. C. 1884-5, p. 304.

CALCITE. Crystals of this mineral have been found at the following localities among others: Bedford; Bruce Mines; Galway; Huntingdon, Kane mine; Loughborough; Madoc 9 XIV; O'Connor, Beaver mine; Sebastopol, lake Clear; St. Ignace island, Thunder bay; Welland, Niagara Falls. "Others perfectly fit for optical purposes were found in abundance

in the upper part of the main shaft of the Galway lead mine in Peterborough county." ¹ Stalactites have been found in numerous places. ²

¹Chapman Min. and Geol. p. 123. ²G. C. p. 334.

CALCAREOUS TUFA. Haldimand, Cayuga; Peel, Caledon; Wentworth, Dundas.

CANCRINITE. Dungannon 13 XI.

CASSITERITE. See tin.

CELESTITE. Barriefield common, Kingston, in Silurian limestone; Forks of the Credit in Medina sandstone. Lansdowne 2 VIII.

SO ¹	42.51
SrO	56.31
BaO	trace
CaO	0.11

G. S. C. 1894, p. 11 R.

99.93

CERARGYRITE. Silver Islet.

CERIUM. This metal occurs in the minerals columbite and allanite.

CHALCANTHITE. Lake, Hastings county, and other localities.

CHABAZITE. Monteaule 24, 25 VI.

G. S. C. 1892-3, p. 27 R.

CHALCEDONY. Lake Superior in amygdaloidal trap; White Beaver lake on Montreal river, green. See also under agate.

CHALCODITE. Madoc, Wallbridge mine, 12 V.

CHALCOCITE. Bruce Mines; Gould, Barron location; Mamainse; Michipicoton island; Parry Sound.

CHALCOPYRITE. This mineral occurs widely distributed in the Sudbury district and in other parts of the Province. The following may be given as representing a few of the numerous localities in which the mineral has been found: Bastard 24 X; Black river, lake Superior; Black bay, Thunder Bay district; Blezard; Chandos II; Denison; Dummer 30 V; Echo bay, Algoma; Escott 7, 16, 17 II; Garrow; Levant 6. 8 VII; Madoc 25 VII; Mamainse; Mattagami lake near H. B. Co. Post, Nipissing district; McKim; North Burgess 1 VI, 5 VIII, 2 IX; Palmerston 2 IX; Parry Sound; Rock lake, Algoma; Round lake, Thunder Bay district; South Canonto 14, 15 III; Wallace mine; Wellington mine; Wollaston.

CHERT. Occurs among the limestones of the Laurentian, Huronian, Trenton, Niagara and Corniferous.

CHLORITE. A secondary constituent of many igneous rocks, and also occurs in certain gneisses and schists. See clinocllore.

CHLORASTROLITE. "Chlorastrolite, while not occurring on the north shore of lake Superior, is found at Isle Royale and Michipicoton island. This beautiful, stellated gem stone, which is sold to a considerable extent as an ornamental stone on all sides of the lake, is of purely American occurrence."

G. S. C. 1887-8, p. 78 S.

CHONDRODITE. Is found in numerous places in the crystalline limestone of the Laurentian, South Crosby, 27 III, Newboro.

CHROMITE. The metal chromium has been detected in some of the non-titaniferous magnetites of Ontario.

B. M. 1897, p. 233.

CHRYSOCOLLA. Lake Superior, found sparingly among some of the copper ores.

CHRYSLITE. See olivine.

CHRYSOTILE. See asbestos.

CLINOCHLORE. Bagot 16 VII.

SiO ₂	27.23
Al ₂ O ₃	19.44
Fe ₂ O ₃	2.17
FeO	4.91
Cr ₂ O ₃	0.99
MgO	32.67
K ₂ O	0.08
H ₂ O	12.04

G. S. C. 1892-3, p. 18 R.

99.53

COAL. "The black, bituminous shales or pyroschists of the Portage-Chemung group contain the remains of terrestrial plants, including a species of calamites, the flattened stems of which are sometimes found to be converted into coal."

G. C. p. 528. See also lignite and anthraxolite.

COBALT. This metal is found in practically all of the nickel ores of the Province, as well as in some of the pyrite of eastern Ontario. It also occurs in traces in some of the mispickel of Hastings county. About 0.5 to 0.6 per cent. of cobalt oxide occurs in some of the iron pyrites of lot 19, concession II of Elizabethtown. The iron pyrites of Escott, 7 II, is also cobaltiferous.

COBALT BLOOM. See erythrite.

COCCOLITE. Beds in crystalline limestone.

G. C. p. 468.

COLUMBITE. Lyndoch 13 XV.

B. M. 1897, pp. 234 to 237.

COPPER. Native copper has been found at the following localities among others: O'Connor, Beaver mine; Point Mamainse; Spar island; St. Ignace island. This mineral occurs at numerous places in the trappean rocks on the north and east shores of lake Superior. Sometimes beautifully crystallized varieties are found associated with calcite, prehnite, laumontite, and at times with red oxide of copper and native silver. Copper ores are sometimes reduced to metallic copper by forest fires. The writer received some specimens of the metal a few years ago from the vicinity of Coe Hill which had evidently been produced in this way. For other copper-bearing minerals of the Province see chalcopyrite, etc.

COPPER GLANCE. See chalcocite.

COPPER SULPHATE. See chalcantite.

COPPER PYRITES. See under chalcopyrite.

CORACITE. "An ore of this rare metal (uranium) is said to occur at Maimanse, where it forms a vein about two inches in width at the junction of the trap and syenite."

Oxide of uranium	59.30
Lime	14.44
Oxide of lead	5.36
Oxide of iron	2.24
Alumina	0.90
Silica	4.35
Carbonic acid	7.47
Water	4.46
Magnesia	trace
Manganese	"
	<hr/>
	98.70
Sp. gr.	4.38
Hardness	3

G. C. p. 504.

CORUNDUM. Burgess 2 IX. "Small crystals of light blue corundum have been found elsewhere in the crystalline limestone of the vicinity."¹ The mineral also occurs as a constituent of igneous rocks—syenite, syenite-pegmatite, nepheline syenite and anorthosite—in a number of counties in eastern Ontario.²

¹ G. C. p. 500, and G. S. C. 1848, p. 134. ² B. M. 1896-7-8; G. S. C. 1896-7-8; Am. Geo. Nov. 1899.

COVELLITE. Rainy Lake district.

G. S. C. 1882-3-4, p. 15 K.

CUPRITE. This mineral is occasionally found associated with native copper and other species in the trappean rocks on the shores of lake Superior.

CYANITE. See kyanite.

DANAITE. Graham N^o 6 III.¹ Some of the mispickel of the Hastings district carries a small percentage of cobalt.²

¹ Chem. Cont. Geol. Can. 1892 and Am. Jr. of Science 1893, p. 75. ² Can. Journal 1870, p. 266.

DATOLITE. Loughborough, Smith and Lacey mica mine. "More magnificent crystals of this species have probably never been found in America, and they are equalled by few European specimens. They are pure and transparent, with a yellowish-green tinge, and enclose only a few small crystals of chalcopyrite as impurities. At first glance they resemble large topaz crystals. In size they measure for the largest crystals 3 x 3½ x 2 c m."¹ The mineral is also stated to occur sparingly in some of the trap rocks of lake Superior.

¹ Am. Jr. Science, pp. 101-102, 1893.

DELESSITE. In the amygduloids of lake Superior and elsewhere.

DIALLAG. Near Parham station in gabbro or norite, and in rocks of similar composition in other localities.

DIOPSIDE. At High Falls and Ragged Chute on the Madawaska river, associated with green hornblende and black tourmaline. The crystals of pale grayish and green pyroxene, often replaced on their acute lateral edges, are sometimes several inches in diameter.

SiO ₂	54.20
CaO	25.65
MgO	17.02
FeO	3.24
Volatile	0.45
	<hr/>
	100.56

Sp. gr. 3.273 to 3.275
G. C., p. 467.

DISTHENE. See kyanite.

DOG TOOTH SPAR. At different localities in limestone.

DOLOMITE. Crystals of this mineral have been obtained at Bruce Mines and in the cavities and geodes of the Niagara formation; also at the exit of Mazinaw lake, and in North Sherbrooke and elsewhere.

DOMEYKITE. Is found mixed with nickeline in a vein cutting a bed of amygdaloid on Michipicoton island. It also occurs on Silver Islet.

G. C. p. 506.

DYSCRASITE. See antimonal silver.

ELÆOLITE OR ELEOLITE. See nepheline.

EMERY. See corundum.

ENSTATITE. Occurs as a constituent of igneous rocks to the north of lake Huron, Lake of the Woods and elsewhere.

EPIDOTE. This mineral is occasionally associated with the granite and gneiss of the Archæan. It is also found in amygdaloids. At Maimanse crystals of epidote are implanted upon mesolite. Magnetite occurs imbedded in a pale green epidotic rock in Marmora, 12 III. Epidote also occurs with iron ore in other deposits. "A peculiar fine grained reddish gneiss, which is traversed by veins of a pea-green epidote and is very ornamental when polished, occurs near Carleton Place in Ramsay." ¹ Tudor 8, 10, 11 XIX.

¹ G. C. p. 833.

EPSOMITE. As an efflorescence on a serpentine rock near the iron ore bed, Crow lake, Marmora. The mineral is also found as an incrustation on the dolomites of the Clinton formation, and in the Utica shales near Collingwood and other places. It is also present in the waters of some springs.

ERUBESCENT. See bornite.

ERYTHRITE. Madoc 2 II, Cross mine; Dominion mine, on magnetite; Prince's mine, lake Superior, as a rose-red incrustation on calcareous spar; s. e. corner Bay of Islands, Bad Vermilion lake; Silver Islet.

FELSPAR. Although this mineral occurs so widely distributed in the Province, the different varieties of it found in most localities have not been definitely determined. Many of the specimens which have been called orthoclase are microcline, and few exact determinations have been made of the lime-soda varieties. See under orthoclase, albite, etc.

FIBROLITE. Dryden 9 III, and elsewhere.

FLINT. Occurs in some of the crystalline and other limestones of the Province, e.g. on Wolfe island in the Trenton, and at Hamilton in the Niagara.

FIBROFERRITE. Rainy River district.

FLUORITE OR FLUOR SPAR. Is found in many localities as a vein mineral. Ross 5 I, 13 VI; Fluor 'island,' Nipigon bay.

FOLGERITE. See under whartonite.

FRANKLINITE. Madoc, Tenney's farm, two miles from Madoc village.

FUCHSITE. Hyman?

GAHNITE. Raglan 2 XVIII, in corundum-bearing rock.

G. S. C. 1896 R.

GALENA. The following are a few of the localities in which this ore of lead has been found: Barrie 5 to 9 IX; Bedford 13 V, 17, VI 18, 19, 21 VIII; Black bay, Granite island; Creighton; Fitzroy 12, 20 VIII; Galway 20A; Garden river, Victoria mine; Grimsthorpe; Lady Evelyn lake, near north end; Lake; Lansdowne 2, 3, 4 VIII; Limerick 1 III; Loughborough 15, 16 IX; Mamainse, Meredith's location; Marmora; McIntyre, Shuniah mine; McTavish, lot C, 8 VIII; Ramsay 5, 8, IV, 3 VI; Rawdon 4 XIII; Silver Islet; Somerville 1 VII; Tudor XIV; Thunder Bay district, Dorion mine, Cariboo mine, Enterprise mine, Victoria mine, Ogema mine, Silver Lake mine.

GARNET. Different varieties of this mineral are found in the Province. The mineral is frequently met with among the Archæan rocks. Barrie; near Levant station in mica schist; Madoc 11 XI; Green island, Moira lake, Madoc, in mica schist; Marmora; Mamainse, with epidote and other minerals in amygdaloid trap. See also andradite.

GAS (NATURAL). Missanabie river, bubbling water. The great natural gas fields of Ontario are in the districts adjacent to the Detroit and Niagara rivers. These fields have been pretty fully described in reports of the Bureau of Mines and Geological Survey. A very valuable paper on the subject by Mr. Eugene Coste will be published in the proceedings of the Canadian Mining Institute for 1900.

B. M. 1891, pages 115 to 164.

G. S. C. 1890-91, pages 1 to 94 Q.

GENTHITE. See nickel gymnite.

GERSDORFITE. Denison 12 III; Graham 2 IV.

GIESECKITE. See agalmatolite.

GLAUCONITE. ". . . bright green streaks and markings in beds of siliceous limestone of the Black River formation in the township of Rama . . . silica, oxyd of iron and water were however detected in its composition, so that it is properly related to glauconite."

G. C. p. 488; also G. S. C. 1853, pp. 195-6.

GOETHITE. In different localities. See under amethyst.

GOLD. This metal has been found at many places in the Province. It may be said that no really large district in the Archæan is without the presence of the precious metal. The two districts in which gold mining is now being actively carried on are widely separated, the one being in the Rainy River country in western Ontario, and the other in the county of Hastings in the eastern part of the Province. Both of these gold-bearing districts have been pretty fully described in the Reports of the Geological Survey and the Bureau of Mines. The following list of places in which the metal has been found will serve to show how widely it is distributed, but they represent only a few of the known localities: Algoma district, in a number of places; Belmont E $\frac{1}{2}$ 19 I, E $\frac{1}{2}$ 20 I; Chandos II; Clarendon 28 VIII; Denbigh,¹ Galway; Kaladar 25 VI; Levant 10 VI²; Marmora 18, 24, 28 V, 4, 5 VIII, 58 IX, 16, 17, 18 XI; Mador 18 V; Nipissing district; Parry Sound district; Rainy River district, numerous localities; South Sherbrooke 12 II³; Thunder Bay district; Vermilion river placers.⁴

¹ G. S. C. 1896. ² G. S. C. 1896.

³ G. S. C. 1896.

⁴ B. M. pp. 256-9, 1897.

GRAPHITE. Bedford 2 VI, 18 IX; Brougham 12, 18 III¹; Denbigh 34 IX; Dunganon 28 XIII; Loughborough 6 IX; Marmora 13 VIII²; North Burgess 10 I; North Elmsley 7 IX; Parry Sound.

¹ G. S. C. 1896. ² G. S. C. 1894, p. 12 R. General, B. M. 1896, pages 34 to 38. G. C. pages 792 to 795. G. S. C. 1866, pages 219 to 224.

GYPSUM. Paris and elsewhere along the Grand river¹, and Moose river, 38 miles above Moose factory. The mineral also occur sparingly at times in the Laurentian e.g. Foxton and Boyd Smith mines in eastern Ontario.

¹ G. C. pp. 347-352.

HALITE. See salt.

HARMOTOME. O'Connor, Beaver mine.

Am. Journal Science, 1891, I p. 161.

HASTINGSITE. Dunganon and other townships with nepheline rocks.

SiO ₂	34.184	MgO.....	1.353
TiO ₂	1.527	K ₂ O.....	2.286
Al ₂ O ₃	11.517	Na ₂ O.....	3.290
Fe ₂ O ₃	12.621	H ₂ O	0.348
FeO	21.979		
MnO	0.629		99.601
CaO	9.867	Sp. gr.	3.433

Am. Jr. Science, Mar. 1896.

HEAVY SPAR. See barite.

HEMATITE. This iron ore is found in a number of places in the Archæan rocks, but is of less frequent occurrence than magnetite. It also occurs in the Potsdam formation. One of the districts which is at present attracting much attention in connection with deposits of this ore is that of northwestern Ontario, which lies adjacent to the Minnesota boundary. The ore bearing rocks of this great iron producing State cross the international boundary at this point. Judging both from the character of these rocks on the Canadian side of the line and from the discoveries of iron ore which have already been made over a considerable area in the district. There is reason to believe that the region will become an important iron producing territory. Another district in which very promising deposits of hematite have been found is that of the Michipicoton mining division. A short account of the iron ore deposits of this district is given in the Report of the Bureau of Mines for 1898, pp. 254 to 258.

The following list of localities will give some idea of the distribution of deposits of the mineral in other parts of the Province: Bathurst 2 IV, 20 X, 23 XI; Bedford, 2 VII; Coffin; Clarendon, 29 XIV; Dalhousie, 1 IV; Darling, 16 IV, 22, 23, 24, 26, 27 XI, 26, 27 XII; Elzevir 2 IV; Huntingdon; Madoc 12 V, 10 VI; Marmora, 13 X; McNabb 6 XIII, 6 C. and D.; Palmerston 1 IX; Portland 4 IX, 7 X; South Canoto 7, 8 III; Storrington.

HESSITE. Gold creek, Pine Portage bay, Rainy River district.

Te.....	35.40
Ag.....	61.01
	96.41
Sp. gr.....	7.968

B. M. 1895, p. 105.

HEULANDITE. See under stilbite.

HISINGERITE. Elizabethtown 19 II.

G. S. C. 1874-5, pp. 304 and 315.

HORNBLende. Occurs frequently as a constituent of metamorphic and igneous rocks. Crystals of the mineral have been obtained at the following localities among others: Bathurst 20 IX; Bedford 21 IX; Ross 7 I, 7 IX; Sebastopol 23 XII, 32 XII.

For analysis of hornblende from the anorthosite of South Sherbrooke see B. M., 1898, p. 227.

HORNSTONE. See chert.

HUMBOLTINE. Kettle point, on black shales.

HUNTILITE. Silver Islet. The analysis of this mineral showed a little over one per cent. of mercury among other things.

Am. Jr. Science, vol. xvii, 1879, p. 486

HURONITE. Missanabie station, and in the vicinity of lake Huron and elsewhere. This substance is an altered plagioclase.

See Ottawa Naturalist, No. 2, 1895.

HYPERSTHENE. Is found as a constituent of certain basic igneous rocks, such as the gabbro or norite near Parham station and other places.

ICELAND SPAR. St. Ignace island and elsewhere. See under calcite.

IDOCRASE. See vesuvianite.

ILMENITE. Occurs frequently as an accessory constituent of rocks and in some iron ore deposits. Hastings county, district of Parry Sound, and Lake of the Woods.

ILVAITE. See lievrite or yenite.

IRON. The ores of iron are mentioned under magnetite, hematite and limonite. Native iron has been found in the Province in meteorites, as well as in rock masses. The following two localities are of interest: St. Joseph's island, lake Huron, fifth concession back of Campment d'Ours,¹ Cameron 7 B, in pegmatite vein as spherules in kaolin. See also meteoric iron.

Fe.....	90.45
Mn.....	0.75
Ni.....	trace
{ S P	
	Organic matter undetermined
Insoluble iron metallic.....	7.26
	98.46
Sp. gr. at 15.5° C.....	7.257

¹ Trans. Roy. Soc. Can., 1890.

IRON OCHRE. Counties of Halton, Leeds, Middlesex, Norfolk and elsewhere. The material has been worked at the following places: Walsingham 12 XIV, Brant 3 II, Limehouse and Mallorytown

IRON PYRITES. See pyrite.

INDICOLITE OR INDIGOLITE. "The velvet black fibrous tourmaline found at Madoc and Elzevir gives a blue powder, and is evidently an indicolite like the variety from Paris, Maine."

G. S. C. 1887-8, p. 67 S.

JAMESONITE. Barrie 10 VIII, 7 IX.

G. S. C. 1892-3, p. 30 R.

JASPER. "Jasper conglomerate exists in mountain masses, along with the quartzite masses of the Huronian series for miles in the country north of the Bruce mines. . . It is a rock consisting of a matrix of white quartzite, in which are pebbles often several inches across, of a rich red, yellow, green or black jasper, and smoky or other colored chalcedony, which form a remarkably striking contrast with the pure white matrix. It is susceptible of a very high polish, and has been made into a great variety of ornamental objects, such as vases, paper weights, etc. Some very beautiful mosaics have been produced by using the rock and included pebbles. . . Considering the abundance of this jasper it seems strange that so beautiful an ornamental stone should have been so long neglected." Jasper of various colours also occurs abundantly inter-banded with iron ores in the districts of Nipissing, Algoma and Thunder Bay.

G. S. C. 1887-8, p. 72 S.

KALINITE. "Occurs in considerable abundance on the exposed face of some high bluffs of argillaceous shale on Slate river, a tributary of the Kaministiquia, about 12 miles west of Fort William."

KAOLINITE. Missanabie river, near the coast. "A red ferruginous variety in strongly soiling particles. . . occurs in Madoc and elsewhere in the counties of Hastings and Peterborough."

Chapman, Min and Geol. p. 119.

KYANITE. Kaladar, Golden Fleece mine;¹ Wahnapiet station, Algoma.²

¹ B. M. 1897, pp 237-8.

² G. S. C. 1897, p. 160 I.

LABRADORITE. A constituent of some igneous rocks. According to Dr. Bigsby a breadth of five miles along the shore of lake Huron about sixty miles west of Penetanguishene is occupied by felspar rocks, among which are found coarse grained varieties of bluish and gray felspar, with purple, green and flame colored opalescence. Wahnapiet station. Drummond 1 III. "The mass of the rock is a confusedly crystalline aggregation of the mineral, with quartz, containing embedded large cleavable masses of it, often several inches in diameter. The color is blackish-green, but when polished or moistened with water, and held in the proper light, the before dark and dull surface glows with hues of azure green and gold, rivalling in beauty the plumage of the humming bird. This locality will furnish abundance of this rare and beautiful ornamental stone." As stated under felspar, few of the varieties of plagioclase of the Province have been definitely determined.

LAUMONTITE. In amygdaloidal trap of lake Superior, Mamainse, etc.

LEAD. Kaministiquia, native. See also galena.

LEPIDOMELANE. Drury 2 II; Dungannon 29 XIII, 25 XIV; Marmora 16 VI, 11 IX, 14 X.

SiO ₂	32.79	Na ₂ O	2.00
Al ₂ O ₃	14.34	TiO ₂	0.92
Fe ₂ O ₃	4.52	H ₂ O at 100° C	1.38
FeO	26.32	H ₂ O above 100° C	3.68
MnO	0.29		
CaO	1.45		99.61
MgO	4.68	Sp. gr. at 15° C	3.19
K ₂ O	7.24		

G. S. C. 1882-3, p. 15 R.

LEUCOXENE. An alteration product of titaniferous iron ore in many igneous rocks, *e.g.*, in the granite of Barriefield common, Kingston, and elsewhere.

LIEYRITE. Vicinity of Ottawa, in a boulder nearly a foot in diameter.

G. C., p. 465.

LIGNITE. Moose river and other localities.

B. M., 1894, pp. 124-5.

LIMONITE. This ore was formerly mined in the Province, but of late years it has not been in demand. Charlotteville; Darling; Middleton; North Elmsley; Windham. One of the most important of the recently discovered iron ore deposits in the Michipicoton mining division is described as a brown hematite or limonite.

B. M., 1898, p. 257.

LINTONITE. See under thomsonite.

LITHIUM. See petalite and spodumene.

LODESTONE. "The finely granular ore of Madoc 11 V, sometimes exhibits polarity, constituting a natural lodestone."

LOGANITE. "Associated with the extensive deposit of crystalline phosphate of lime in North Elmsley is a mineral closely resembling the loganite in its characters. . . . A mineral almost identical with this occurs in North Burgess in a pyroxenic rock, with large crystals of a magnesian mica, which last has been wrought to a considerable extent. The results of an analysis of this mineral gave

SiO ₂	39.70
Al ₂ O ₃	14.20
FeO	4.50
MgO	25.84
H ₂ O	16.20
	100.44
Sp. gr.	2.32 to 2.35

LOLLINGITE (Cobaltiferous). Galway 16 XIV.

	I.	II.
As	70.11	70.85
S	0.80	0.81
Fe	24.41	24.67
Co	2.85	2.88
Ni	0.78	0.79
Gangue (quartz)	1.69	.....
	100.64	101.00

MACFARLANITE. Silver Islet.

Can. Nat. Feb. 1, 1870.

MAGNETITE. The magnetites occurring in the Province are conveniently grouped into two classes, viz.: 1. Titaniferous magnetites. 2. Non-titaniferous magnetites. The titaniferous varieties occur in many places in the eastern part of the Province, and in one or two places in the Rainy River district. The following are analyses of specimens from four of these deposits¹:

—	Fe ₃ O ₄	TiO ₂	S	P	Siliceous rock matter.
Minden 11 I	71.22	25.51	0.43	trace	5.13
Glamorgan 35 IV	71.87	13.30	0.06	0.005	15.28
Tudor 55-57 of the Free Grant dist	83.86	8.08	0.08	0.007	9.31
South Crosby 26, 27 VI ²	69.77	9.80	0.085	1.520	.....

¹ Chapman, Trans. Roy. Soc. Can. 1885.

² Analysis by T. S. Hunt.

Other well known deposits of titaniferous magnetite are the so-called Boyd-Smith mines near Parham station and the Chaffey mine near Newboro on the Rideau canal. The percentage of titanium in these ores varies greatly. In some cases it is present in little more than traces while in other cases it is present in percentages so high that the iron is largely replaced.

Attempts have been made to work some of these deposits, but at present nothing is being done with them on account of difficulties which it is claimed are met with in smelting them. All of these titaniferous ores contain nickel and are believed to be of igneous origin. They are associated with gabbro-like rocks ¹.

The non-titaniferous magnetites are of aqueous or sedimentary origin.

The following are some of the localities in which magnetites of one or the other of the two classes mentioned occur: Airey; Bagot 14 VII, 16, 21 VIII, 16 IX, 23 X, 16, 18, 22 XI ²; Bathurst 11, 12 VIII, IX; Bedford 2, 5 II, 2, 3, 5, 6 III, 1, 4, 7, 8, 9 IV, 1, 3, 7 to 11 V, 2 VI, 2, 3, 4, 7 VII, 21 IX; Belmont 8, 19 I; Carlow 6, 7 XVI; Darling 22 III, 22 IV, 25 V; Digby 15 VIII; Dungannon 25 XIV; Galway 23 XII, 27 XIII; Glamorgan 35 IV, 30, 31 XIII; Levant 13 III, 4 VII, 4 XII; Lutterworth 5 V, VI, 16 VII; Madoc 2, 12 IV, 11 V, 10 VI, 9 VII; Marmora 7 I, 13 II, 12 III, 6, 9 IX; Minden 11 I; North Crosby, 1 VI; Palmers-ton 3, 4 IX, 8 X, 27, 28 XI; Portland 5 XIII; Seymour 25 XII; Snowdon 20 I, 33 III, 25, 26, 27 IV; South Crosby 26, 27 VI; South Sherbrooke 3, 14 I, 17, 18, 19 III; Wollaston 15, 16 II, 16, 17, 18, 19 VIII, 9, 10 XV.

The non-titaniferous magnetites of western Ontario differ for the most part considerably from those of the eastern part of the Province. Those of the former region, especially those of the Rainy River and Thunder Bay districts, are frequently very fine grained and slaty in appearance, and are associated with rocks which often hold a high percentage of jasper and related minerals. The non-titaniferous magnetites of eastern Ontario are usually much coarser in grain and are associated with rocks of a different character. In many cases the rock on one wall of these deposits is crystalline limestone, while that on the other varies in different deposits. Frequently however it is some variety of scapolite bearing gneiss.

The development of our iron ore deposits is as yet only in its infancy. In working the deposits of the eastern part of the Province we should draw upon the experience which has been gained in working the deposits of the eastern United States, which are similar in character. The iron ores, both hematites and magnetites, of the Michipicoton, Thunder Bay and Rainy River districts are on the other hand, like those of the States of Michigan and Minnesota, and the knowledge gained by workers of the deposits in those States should prove of great value to us in developing the iron resources of our western districts. The following are some analyses of non-titaniferous magnetites from eastern Ontario, given in a paper, by Prof. E. J. Chapman, published in the Trans. Roy. Soc. of Canada in 1885.

	FeO	Fe ₂ O ₃	MnO	S	P	Siliceous rock matter.	CaCO ₃	Amount of metallic iron deduced from oxides.
1. Snowdon 26 IV.	26.20	58.72		0.16	0.01	15.02		61.48
2. " 20 I	24.87	58.35	0.13	0.04	0.08	15.58		60.18
3. " 25 IV.	76.72		0.11	0.08	0.02	23.84		55.00
4. " 27 IV.	69.62			trace	trace	29.94	0.48	50.41
5. Galway 27 XIV	86.83		trace	trace	trace	13.27		62.87
6. " 23 XII	86.46		1.27	trace	0.01	12.18		62.60
7. Lutterworth 5 VI.	76.12			trace	trace	23.80		
8. Glamorgan 27 XIII.	30.06	67.14		trace	trace	2.74		70.38
9. Monmouth 30 XIII.	30.08	67.27		trace	trace	2.58		70.50
10. Belmont 19 I	27.22	61.56		0.04	trace	11.13		64.26
11. Burleigh	27.14	60.82		0.03	trace	11.54	0.61	63.68
12. Madoc 25 VI	28.40	67.23	trace	0.03	0.04	3.32	0.87	69.16
13. " 11 V	25.79	57.52	trace	0.52	trace	15.54		60.32
14. " 11 V	26.68	59.71		0.38	0.03	13.16	0.11	62.54
15. " 18 I	29.47	65.68		0.07	0.01	4.74		68.90
16. Wollaston 15, 16 VIII	26.12	65.20		0.09	0.02	8.48		
17. Tudor 6, 7 8 XIX.	28.32	63.24		0.02	trace	8.36		63.30
18. " 18 XVIII.	29.18	64.95		0.13	0.01	5.66		68.16

¹ B. M. 1897, pages 230-2 and Proc. Brit. Ass. Ad. Science, 1897.

² G. S. C. 1895, p. 19 R.

MALACHITE. Lake Huron, lake Superior, Madoc, Marmora, Parry Sound and elsewhere with other copper ores.

MANGANESE. This metal occurs in small amounts in some of the iron ores of the Province. See also manganite, wad and rhodochrosite.

MANGANESE OCHRE. See wad.

MANGANITE. "At Batchewaning bay on lake Superior, near the southeast end of the Upper Canada Mining Company's location, and not far from the shore, is a large vein of manganese ore. . . . A specimen was found by assay to be equal to 60 per cent of peroxide of manganese."

MARCASITE. Hinchinbrook, Silver Islet, Nesbing 25 V.

Can. Journal, 2nd series x, p. 408.

MARSH GAS. Is abundant in some mineral springs where it keeps the waters in constant agitation.

MARTITE. Dalhousie 1 IV; in a gneissoid boulder from Bass lake a few miles north of Orillia.

MELANITE.—Marmorata and elsewhere. See garnet.

MELANTERITE. Occurs on decomposing pyrite and marcasite in many localities, e.g., Hastings and lake Superior. "A specimen of iron pyrites from the Galway lead mine in . . . Peterboro', became covered in the course of a few weeks with delicate tufts of minute acicular crystals of the mineral."

Charman Min. and Geol. p. 133.

MENEGHINITE. Barrie 5 to 9 IX.

Trans. Roy. Soc. Can. 1883.

MERCURY. See under huntelite.

MESOLITE. "At Mamainse crystals of epidote are met with implanted upon mesolite, and rarely associated with small brown garnets."

METEORIC IRON. Madoc. "The specimen was found in 1854 upon the surface of a field and weighed 370 pounds. Its shape is rudely rectangular, and flattened on one side. The surface is irregularly pitted, as is generally the case with meteoric masses, and coated with a film of oxide of iron. The iron is malleable and highly crystalline in texture, and when etched by an acid exhibits beautifully the peculiar markings which are known as Widmanstättian figures. Its analysis shows it to be an alloy of iron with 6.35 per cent of nickel. Small portions of the phosphorus of nickel and iron are disseminated through the iron, and, in making a section of it, rounded masses of magnetic iron pyrites were met with."¹ This meteorite is now in the collection of the Geological Survey, Ottawa.

Thurlow meteorite. Found May 12th, 1888, on lot 28 VI, Thurlow, Hastings county. Weight of original mass 11 lb. 15½ oz.

In Ward's "Descriptive Catalogue of Meteorites," Rochester, 1892, two other meteorites found in Ontario are described.

One known as the Welland meteorite is said to have been found April 30th, 1880, about one and one-half miles north of the town of Welland. It is stated to be a kidney shaped mass, and its total weight after being freed from all loose scales was 17¾ lb.²

Fe	91.17
Ni	8.54
Co	0.06
S	0.07
	<hr/>
	99.84
Sp. gr	7.87

The De Cewsville Meteorite. "It fell in the village of De Cewsville about 2 p.m., Jan. 21st, 1887, striking in the ditch on the south side of the street known as the Talbot road, opposite lot No. 43, con. 1. The ditch at the time contained about a foot of water, from a recent thaw, which was covered with thin ice. The meteorite made a hole in the ice about a foot in diameter. The whizzing noise in the air and the splash in the water were heard and the latter seen" by one person who was about 15 feet distant from the spot struck, and by two others who were near at hand. The meteorite seemed to have come from the west. It was found, after the melting of the snow and ice, on Feb. 16th. Its weight is about 12 oz. and its specific gravity 3.52, which is somewhat greater than that of most aërolites, and it doubtless contains a little more iron than is usual in meteorites of this class.³

¹ G. C. p. 508.

² Proc. Rochester Acad. Sci. vol. i, 1890.

³ Ibid.

MICA. The mining of amber mica is a somewhat important industry in the county of Frontenac and adjoining territory in the eastern part of the Province. The village of Sydenham has been one of the chief centres of the industry. The mineral has been mined to some slight extent in other parts of the Province. Good specimens of mica have been obtained at different places in the region north of lake Huron.

The following are some of the localities in which specimens of merchantable mica have been obtained: Cardiff; Ettingham; Hungerford; Levant; Loughborough 8 III, 11 VII, 5, 8 VIII, 16, 17 IX, 7, 8 X;¹ Methuen 14 IX, 14 X; Miller 4, 5 XI; North Burgess 2 IV, 16, 17 IX; Palmerston 24 II; South Canonto; Wilberforce Station. Chrome-magnesia mica occurs on 6 I Hyman.

See also biotite, muscovite, phlogopite, sericite and fuchsite.

¹ B. M. 1892, pages 249 to 250.

MICROCLINE. Much of the so called orthoclase proves on close examination to be microcline. See also amazon stone and aventurine.

MILLERITE. Has been reported to occur in the Sudbury district in the massive form.

MINERAL WATERS. These are somewhat widely distributed in the Province and differ greatly in the amount and character of the salts dissolved in them. Accounts of these waters

are given in the Geology of Canada, 1863, and in other reports of the Geological survey, especially in those parts of the annual reports entitled "Mineral Statistics" and "Chemical Contributions." In the Report of the Bureau of Mines for 1891, pages 60 to 62, an account is given of the mineralized artesian waters of the Province.

The following table shows the composition of a few of the mineral waters of Ontario. The analyses are taken chiefly from the Geology of Canada, 1863, where it is stated that "The mineral waters of Canada can be arranged in six classes, according to their chemical composition. In the first three classes chlorids predominate; in the fourth, carbonates; and in the fifth and sixth, sulphuric acid and sulphates. The waters of the first, second and third classes are neutral; those of the third and fourth are alkaline; and those of the fifth are acid."

—	1	2	3	4	5	6	7	8	9
Chloride of sodium				17.8280	18.9158	29.864	12.2500	6.9675	6.5325
“ potassium				0.0920	traces		0.0305	0.0309	0.1160
“ barium					traces				traces
“ strontium									traces
“ calcium				12.8027	17.5315	12.894	0.2870		
“ magaesium .....	.0878			5.0737	9.5437	6.954	1.0338		
Bromide of sodium				0.1178	0.2482			0.0150	0.0217
“ magnesium							0.0238		
Iodide of sodium					0.0008			0.0005	0.0032
“ magnesium							0.0021		
Sulphate of alumina .....			.4681						
“ lime	1.1267	1.240	.7752	0.7769	.0396				
“ magnesia .....	.4351	.207	.1539		.492				
“ potash .....	.0510		.0608					0.0053	
“ soda .....	.4718		.0502						
“ protoxyd of iron .....			.3638						
Phosphate of soda									0.0124
Carbonate “								0.0485	0.0885
“ baryta									traces
“ strontia					traces				traces
“ lime .....	.3050	.198		traces	0.0411	0.370	0.1264	0.1480	0.1500
“ magnesia .....	.0179				0.0227	1.287	0.8632	0.5262	0.7860
“ iron	traces				traces		traces	traces	traces
Phosphoric acid			traces						
Hydrated sulphuric acid			4.2895						
Sulphuretted hydrogen .....	.1776								
Alumina							traces	0.0044	0.0040
Silica							0.0225	0.0010	0.1330
In 1,000 parts of water	2.495	1.645	6.1615	36.6911	46.3038	52.257	14.6393	7.7773	8.8473
Specific gravity			1.0058	1029.1		1013.2	1010.9	1005.8	1006.24

1. Charlotteville 3 XII, Corniferous formation. "A remarkable sulphurous spring, belonging to the sixth class. . . . The water fills a natural basin, covering about 100 square yards, from which the discharge was found to be about sixteen gallons a minute. The water rises through several holes in the mud at the bottom of the basin. This is covered with a layer of sulphur and carbonate of lime, a mixture of which incrusts leaves and twigs placed in the spring. The water is remarkable for the predominance of earthy sulphates and for the great amount of sulphuretted hydrogen which it contains, amounting to 11.6 cubic inches in 100 cubic inches of water. . . . The temperature of this water in the basin was 45°F. . . . It is limpid and sparkling, and pungent to the taste from the great amount of sulphuretted hydrogen it contains."¹

2. Brant, lot 53.

3. Tuscarora, known as the sour spring, is upon the Indian reserve about nine miles south of Brantford and three miles south of the bank of the Grand river. The water is kept in constant agitation by a discharge of inflammable gas. The presence of sulphuretted hydrogen is also evident from the odor.

4. The water is from a salt well about two miles east of the village of Ancaster.

5. Whitby. A copious saline spring occurs at Bowerman's Mills, 32 III. Contains an abundance of bromine, but only traces of iodine.

6. "In boring for water at Morton's distillery in Kingston two mineral springs were met with. . . . They are remarkable for the large proportions of sulphates and earthy carbonates which they contain." The analysis given is from what was known as the upper well.

7. Caledonia. The spring from which this water is taken is known as the intermittent spring on account of the intermitting discharge of carburetted hydrogen gas.

¹ G. C. pages 536-7.

8. Caledonia. This water comes from what is known as the gas spring, something like 300 cubic inches of carburetted hydrogen gas being evolved per minute. Trenton group.

9. Fitzroy, 10 II, Gillan's spring.

MISPICKEL. This mineral is found associated with gold in a number of widely separated places in the Province. At Deloro in Marmora oxide of arsenic is produced along with gold. This appears to be the only district in America producing arsenic, although one locality in the western United States is referred to in certain text-books. Barrie; Marmora; Lake; Tudor; Lake Temagami district; Rainy River district. The mineral is found sparingly in the last districts, and associated with copper ores at the Bruce Mines and Thunder bay. See also danaite. A cobaltiferous mispickel from the township of Graham was found by Mr. G. R. Mickle to have the following chemical composition:

As	47.60	S	4.59
Fe	46.27	Co	1.52

MOLYBDENITE. There are numerous localities in which this mineral occurs, among which are the following: Dungannon; Harcourt 3 I; Miller 3 VIII; Montezale 26, 27 VI; North Crosby; Ross 22 II, 7 IX; Terrace Cove, lake Superior, in small quantities in a quartz vein.

MOLYBDITE. Ross 22 II.

MORENOSITE. Denison 12 III; Drury 2 II; Wallace mine at the mouth of the Whitefish river.

MOUNTAIN LEATHER. O'Connor, Beaver mine.

MUSCOVITE. Occurs widely as a constituent of crystalline rocks. Good specimens of the mineral have been obtained at the following places among others: Calvin 16 II; Dungannon 20 X; Methuen, on different lots in concessions IX and X; Miller 4 XI; Matawachan (chromiferous); Lake of the Woods.

NAGYAGITE. Moss, Huronian mine?

NATROLITE. "Occurs, but mostly in a weathered condition and in part altered to carbonate of lime, in some of the amygdaloidal traps of lake Superior."

Chapman Min. and Geol. p. 113.

NEPHELINE. Occurs as a constituent of igneous rocks, sometimes forming a large part of the rock mass, over a large extent of territory in the counties of Renfrew, Hastings, Peterborough and the district of Haliburton¹

"Grains of orange-red nepheline or elaeolite are abundant with black hornblende in a white felspathic rock which is found in boulders on Pic island in lake Superior."²

Nepheline is also a constituent of a certain rare type of rocks which occur near Poohbah lake in the Rainy River district. These rocks have been described by Dr. A. C. Lawson.³

¹ Am. Jr. Science, July, 1894. Reports B. M. 1897 and 1898. Reports G. S. C. 1897 and 1898.

² G. C. p. 480. ³ Bull. Dep. Geol., Univ. Cal., vol. i, No. 12, pp. 337-362, 1896.

NICCOLITE. Denison 12 III; McGregor 3 A mine; Michipicoton; Silver Islet.

NICKEL. The chief ore of this metal in the Province is the nickeliferous pyrrhotite of the Sudbury district. Nickel also occurs in small amounts in titaniferous magnetites. See pyrrhotite.

NICKEL ARSENATE (hydrous). Denison 12 III.

G. S. C. 1892-3, p. 29 R.

NICKEL GYMNITE. Michipicoton island, in a vein cutting amygdaloid.

G. C. p. 506.

NIOBATES. See columbite.

OCHRE. Ochre occurs in different parts of the Province, the following being among some of the best known localities: Blythfield, 5 to 10, II and III; Nassagaweya; Nottowasaga; Owen Sound. See also under iron ochres.

OIL. See under petroleum.

OLIGOCLASE. This felspar undoubtedly occurs as a constituent of many of our crystalline rocks, but its character has been definitely determined in only a few cases.

OLIVINE. Is found as a constituent of a number of basic rocks, such as the diabase of Sudbury.

OPHIOLITE. See serpentine.

ORTHITE. See allanite.

ORTHOCLASE. A constituent of many igneous and metamorphic rocks of the Province. Microcline is the most common form of potash felspar in our Archean rocks. Microperthite is also of quite common occurrence and is frequently mistaken for orthoclase. Good specimens of orthoclase have been obtained at the following localities: Bathurst 20 IX; North Crosby; North Burgess; Sebastopol 31 XI, 23 XII. Coarse pegmatite dikes containing felspar suitable for use in pottery occur in the Kingston district and elsewhere throughout the Province.

OXALITE. Kettle Point, Bosanquet, on black shales.

PALLADIUM. See under sperrylite.

PARGASITE. High Falls and Ragged Chute on the Madawaska river ; well terminated dark green crystals embedded in greenish-white pyroxene.

SiO ₂	55.05
Al ₂ O ₃	4.50
FeO	5.85
CaO	13.44
MgO	20.95
Volatile	0.35

Sp. gr 100 14
G. C. p. 466. 3.050-3.058

PEAT. Many years ago the late Dr. Sterry Hunt gave considerable attention to the character and occurrences of the peat deposits of the Province. He made numerous analyses and tests of the material concerning its value as a fuel. The results of his work are given in the reports of the Geological Survey for 1845-6, p. 96, 1849-50, pages 97-99, 1853-56, pages 425 to 426, and in the general report of 1863 the question of the manufacture and application of peat was discussed in considerable detail, pages 771-784.

More recently the subject of peat has again attracted considerable attention and has been treated of in some of the reports of the Bureau of Mines, 1891, pages 206 to 210, 1892, pages 195 to 220, 1894, pages 32 to 34, 1896, pages 185 to 192, and in the publications of the Geological Survey. The chief occurrences of the material are given in these reports.

PECTOLITE. McKellar's (Catheart) point, lake Superior.

PENTLANDITE. Drury 2 II, Worthington mine, and other places in the Sudbury district.

Am. Jr. Science, 1893, p. 493.

PERISTERITE. "This beautiful variety of albite exhibits a peculiar bluish chatoyancy or opalescence, sometimes mingled with pale green and yellow, and called 'moonstone.' It is found in crystals and by the ton in large cleavable masses, containing disseminated grains of quartz in veins cutting the Laurentian strata at Bathurst (19 IX), also in crystals on the north side of Stony lake, near the mouth of Eel creek, in Burleigh, in large opalescent cleavable masses of reddish albite, and on the 9th line or concession north of Perth on the land of Robert McEwen. This beautiful material is especially adapted for use in the arts."¹

The following is an analysis of a specimen from the Bathurst locality by Dr. Sterry Hunt :

SiO ₂	66.80	Fe ₂ O ₃	0.30
Al ₂ O ₃	21.80	Ignit on.....	0.60
K ₂ O	0.58		
Na ₂ O	7.00		99.80
CaO	2.52	Sp. gr	2.625
MgO	0.20	H	6.

The material also occurs in Bromley.

¹ G. F. Kunz in G. S. C. 1887-8, p. 75 S.

² G. S. C. 1850, p. 36.

PERTHITE. Cameron 7 B ; Dungannon 20 X ; North Burgess 4 VI.

	I.	II.		I.	II.
Si O ₂	66.44	66.50	K ₂ O.....	6.37	6 18
Al ₂ O ₃	18.35	19.25	Na ₂ O.....	5.56	5.56
Fe ₂ O ₃	1.00		H ₂ O	0.40	0.44
Ca O.....	0.67	0.56			
Mg O.....	0.24	0.24	(Ignition)	99.03	98.73

Hunt, G. S. C. 1850, p. 36.

PETALITE. "Petalite is here mentioned among the minerals of Canada upon the authority of Dr. Bigsby, according to whom this mineral was found, with tremolite, in a large boulder on the lake shore at Toronto."

G. C. p. 481.

PETROLEUM. This substance is found in different Palaeozoic limestones in small quantities filling cavities in corals and other fossils. It also occurs in the shales of the Utica formation. A spring carrying some of the material rises through these rocks on the Grand Manitoulin island. Utica shale when freshly exposed can often be caused to burn on the surface. These shales, at one time, before the discovery of oil wells in the Province, were used for the distillation of petroleum. The shales of Collingwood gave 4 to 5 per cent of oily matter. The Devonian shales of Kettle point by experiment on a small scale gave 4.2 per cent of crude oil, together with a portion of ammoniacal water. The oil fields of Ontario are situated in the territory lying between the southern point of lake Huron and the northwestern shore of lake Erie. Full accounts of these fields are given in the reports of the Bureau of Mines and Geological Survey.

B. M. 1895, pages 21 to 29.

G. S. C. 1866, pages 233 to 262 ; 1890-91, pages 1 to 94 Q.

PHLOGOPITE. This is the mica of commerce in Ontario, and is generally called amber mica on account of its color. It is of frequent occurrence in association with the crystalline limestones and pyroxenic gneisses of the Laurentian. Apatite and phlogopite both occur in economic quantities in some deposits. North Carolina and India are producers of white mica, but as yet very little of this variety of the mineral has been produced in Ontario, although there is evidence that it occurs in economic quantities in some localities. The following is an analysis of phlogopite from North Burgess, which township lies in the chief mica producing district of the Province :

SiO ₂	40.97	Na ₂ O	1.08
Al ₂ O ₃	18.56	Volatile	1.00
FeO	none.	Loss, which is probably	
Fe ₂ O ₃		fluorine	4.33
MgO	25.80		
K ₂ O	8.26		100.00

G. C. p. 45.

PHOLERITE. "Occurs in the form of white unctuous films in the joints of many quartzose sandstones of the Huronian series; and what appears to be the same mineral is occasionally met with in small botryoidal masses lining cavities in the Jasper conglomerate of the same series."

G. C. p. 495.

PICROLITE. Ross 8 IX.

G. S. C. 1882-3-4, p. 14 L.

PLAGIOCLASE. See albite, oligoclase, andesine, labradorite, bytownite and anorthite.

PLATINUM. See sperrylite.

PLUMBAGO. See graphite.

POLYCRASE. Calvin.

G. S. C. 1897, p. 61 I.

POLYDYMITE. Denison 5 IV, Vermilion mine; Drury 2 II.

PREHNITE. "Prehnite is associated with native copper and calcite in the lake Superior region, Michipicoton, etc., where it is often of a rich green color in spherical masses of crystals an inch across, or in aggregations even larger, affording a curious but pleasing green stone resembling a chrysoprase."¹

It sometimes forms distinct veins in the trap rocks, as on Slate river, an affluent of the Kaministiquia.

SiO ₂	43.41	H ₂ O	4.14
Al ₂ O ₃	23.80		
Fe ₂ O ₃	1.26		99.76
Mn ₂ O ₃	0.53	Sp. gr	2.88
Ca O	26.62		

¹ G. S. C. 1887-8, p. 77 S.

² Chapman Min. and Geol. p. 111, and Can. Journal, 1870, p. 267.

See also chlorastrolite.

PYRALLOLITE. See reusselaerite.

PYRITE.—Good cabinet specimens of this widely distributed mineral are found at numerous places in the Province. The mineral is frequently auriferous, and in some cases has been found to carry nickel and cobalt. Deposits of it have been developed to some extent with the object of securing a supply of the material for use in the manufacture of sulphuric acid, for which it is in considerable demand. These deposits are situated in the townships of Darling and Elizabethtown and, near Schreiber on the Canadian Pacific Railway. There are no doubt numerous workable deposits in the Province. Bedford, Devil's lake; Big river, a tributary of the Opazatika¹; Darling 5 IV; Elizabethtown 19 II; Hungerford; Graham 12 III; Madoc 11 XI²; near Schreiber station on the C.P.R.; Nickel lake, Rainy River district; lake Temagami, Nipissing district.

B. M. pp. 255-6, 1895.

² G. S. C. p. 106, 1866.

B. M. p. 74, 1894.

PYROXENE. There are a large number of localities in the eastern crystalline area of the Province in which large well formed crystals of this mineral are to be found. Bathurst 20 IX; Bedford, Toomah bay; Carlow; Herschel 3 IV; North Burgess 2 IX; Sebastopol 23 XII and Turner's island in lake Clear. See also augite, diallage, hypersthene, aegirine, etc., etc.

PYRRHOTITE. Through the replacement of some of the iron in pyrrhotite by nickel it becomes the ore of this metal in the Sudbury district. The deposits are claimed by most authorities to be of igneous origin. Pyrrhotite is found occurring in large masses in other parts of the Province, especially in the east, but in these cases it carries little nickel. In these deposits the mineral appears to be of aqueous origin. The map of the Sudbury district which accompanies this annotated list of minerals shows the location of the chief deposits of pyrrhotite in the vicinity of Sudbury, and it is not necessary to refer further to the localities. Some of the chief localities in which non-nickeliferous pyrrhotite occurs are the following: Dalhousie 22 II, 18 III¹; Elizabethtown 19 II; Galway; Monteagle; Madoc 10 II; Olden; Wollaston 15 II, 22 IX. The following are the averages of the analyses of copper-nickel ores from one pro-

¹ G. S. C. 1897.

perty in each of five townships in the Sudbury district, the percentage given in each case being the average of several analyses :

	Nickel.	Copper.
1	2.62	0.78
2	2.62	0.13
3	2.99	0.30
4	1.9†	0.62
5	2.26	2.80

QUARTZ. In addition to the occurrence of this mineral in irregular forms as a rock and vein constituent, it has been found at numerous localities in crystals. Bruce Mines ; Madoc IX ; Thunder Bay. See also amethyst, agate, jasper, chalcedony and chert or hornstone, smoky quartz at Thunder bay and elsewhere. Some of the quartzites, such as those on the north shore of lake Huron in the vicinity of Killarney consist entirely of pure quartz, and are adapted to most purposes for which quartz is required.

RAPHILITE. Bathurst 26 XII ; Dalhousie ; Bedford.

G. S. C. 1892 p. 69 A.

RENSSELAERITE. Charleston lake, coarsely columnar radiating variety.¹

SiO ₂	61.90
FeO	1.45
MgO	30.42
H ₂ O	6.54
	<hr/>
	100.31
Sp. gr.	2.64†

Ramsay 8 VI. "It is on the east side of the lot towards the front and runs in a general way with the length of the lot. It appears to be between a bed of quartz on the one hand and crystalline limestone on the other, and considerable masses might be obtained from it." It is economically applicable to the purposes for which soapstone is used and several others besides. Being of a tougher nature and not liable to exfoliate, it is more durable and receives a higher polish.²

¹ G. C. p. 471.

² G. S. C. 1856 p. 44.

RHODIUM. See under sperrylite.

RHODOCHROSITE. Silver Islet and McKellar island, lake Superior.

ROCK SALT. See salt.

RUTILE. "Rutile in delicate acicular crystals has been observed in drusy cavities, with quartz, at the Wallace mine on lake Huron."¹

"In the vein on the coast near the mouth of the Spanish river, rutile occurs in delicate acicular crystals."²

Madoc, Green island, Moira lake.

Minute grains of rutile also occur with the black magnetic sands on the shores of lakes and rivers.

¹ G. C. p. 502.

² G. S. C. p. 63; 1848-9.

SALT. Halite, commonly known as "salt," occurs in the strata underlying a considerable area in the western part of the Erie and Huron peninsula, and is present in appreciable amounts in many mineral springs. Strongly saline waters have been met with in drilling for gas in places in eastern Ontario.¹

The following is an analysis of a salt produced at Seaforth :²

NaCl	98.2778
CaSO ₄	1.2515
MgCl ₂	0.0078
H ₂ O	0.6832
Insoluble	0.0160
	<hr/>
	100.2363

¹ R. Com. pages 181 to 191.

G. S. C. 1869 p. 211, and 1874-5 pages 267 to 300.

² Can. Ec. Min. Can., Phil. Int. Ex. 1876.

SAMARSKITE. Lyndoch ?

SAPONITE. In some of the silver veins of the Port Arthur district, e.g. Beaver mine.

SAUSSURITE. This secondary aggregate is found in many rocks, e.g., the saussurite gabbro of the Rainy River district.

SCAPOLITE. Good crystals of large size are frequently found in mica and apatite deposits. The mineral also occurs as an essential constituent of certain gneisses in the eastern part of the Province. These scapolite gneisses frequently form one wall of some of the magnetite deposits. See also under sphene.

Can. Rec. Science 1889 p. 198.

B. M. 1898 p. 229.

SCHORL. See tourmaline and indigolite.

SELENITE. Haldimand county, Mount Healy ; Moose river ; Niagara Falls. The mineral also occurs sparingly in certain mineral deposits in the Archæan rocks, e.g., in the apatite deposit of the Foxton mine, Frontenac county. See also gypsum.

SELENIUM. A trace of selenium is said to be present in a galena which is found in a vein near the mouth of Black river, lake Superior.

SERICITE. This mica occurs in metamorphic rocks, such as the sericite schists of the north shore of lake Huron.

SERPENTINE. This mineral is found quite widely distributed among the older crystalline rocks. It sometimes forms rock masses and is frequently mixed through crystalline limestone the two forming together a fine decorative material.

Some interesting notes are given by Lawson on the serpentines of the Rainy River district in the Report of the Geological Survey for 1887-8 pages 45, 50, 97, 98 and 180 F.

In eastern Ontario the mineral is often associated with the so-called eozone limestones. It is also found in smaller amounts in some of the iron ore beds of Belmont and Marmora; Bedford 6 III; North Burgess 2 VIII; Marmora 13 IX; Rainy Lake district, at the south end of lake Despair and the north end of Clearwater lake.

B. M. 1891 p. 81, 1894 pages 73, 76, 93.

G. C. pages 471 to 473.

SIDERITE. Elizabethtown; Lake Superior; Marmora; McIntyre.

SILLIMANITE. In Hastings county as a constituent of crystalline schists. See also fibrolite.

SILVER. This metal is found in the native state in a number of deposits in the Port Arthur district. A somewhat detailed description of these deposits is given in the Report of Geological Survey for 1887-8, pages 5 to 131 H and pages 88 to 96 S. "The Story of Silver Islet" will be found in the Report of the Bureau of Mines for 1896, pages 125 to 158. Silver is also present in some of the galena of the Province, as in that of the township of Barrie, which is associated with a number of other metallic minerals. Quite recently a sample, consisting of galena, sphalerite and pyrite, obtained from a vein in the crystalline limestone in the township of Olden, was assayed in the laboratory of the Kingston School of Mining and found to contain 22 oz. of silver to the ton. See also argentite.

SMALTITE. McKim; Madoc 2 II; Dominion iron mine.

G. S. C. 1895, p. 129 A.

SOAPSTONE. See steatite.

SODALITE. Dungannon 29 XIII, and other localities in the counties of Hastings, Renfrew, Peterborough and the district of Haliburton in nepheline-bearing rocks, frequently associated with corundum.

SPERRYLITE. Vermilion mine, township of Denison. An analysis of the mineral, from this deposit, made by Prof. H. L. Wells of Yale, gave the following results:

As.....	40.98
Sb.....	0.50
Pt.....	52.57
Rh.....	0.72
Pd.....	trace
Fe.....	0.67
SnO ₂	4.62
	<hr/>
	99.46

Small amounts of platinum also occur in some of nickel-copper ores of the Sudbury district, and it is probable that the metal occurs in these in the form of sperrylite.

Am. Jr. Science, vol. 37, p. 67, 1889; B. M. 1892, pages 179 to 180.

SPHALERITE. This mineral is found widely distributed in veins and in limestone rocks and is usually associated with galena. It occurs in grains scattered through crystalline limestone in many places, and also in veins in the same class of rocks. "It occurs in some of the veins on lake Superior, as at Mamainse and at Prince's mine, where it is abundant with copper glance and native silver. . . . Blende is also occasionally met with in small masses of a honey-yellow color, imbedded in the limestones of the Trenton group at Kingston. . . . and in the dolomites of the Niagara formation in the west. At Niagara Falls it sometimes appears to replace fossils; and at other times occurs in beautiful wax-yellow cleavable masses imbedded in nodules of gypsum." The larger deposits of the mineral hitherto discovered are situated in the Port Arthur region. Balfour 6 I; Barrie 5 to 9 IX; Blende lake, Thunder Bay district; Dorion 10 VI; McKellar island; McIntyre, Shuniah mine; Paresseux rapids, Kaministiquia river; Point aux Mines, lake Superior; Silver lake, Thunder bay; White Sand river, Zenith mine; Marmora 1 XI.

† G. C. p. 514.

SPHENE. This mineral is of quite common occurrence among the crystalline rocks of eastern Ontario. "Dr. A. E. Foote described a new locality for sphene and associated minerals at Egansville, Renfrew county, Canada. The sphene occurs in immense crystals, weighing from 20 to 80 lb. in a vein of apatite 20 feet wide. Many other veins of smaller size occur in the same county. The rock is primary gneiss and granite. A solid mass of sphene, very highly cleavable, 5 x 2 x 2 feet, was observed in the side of the vein. It yielded several hundred pounds of sphene. Close to it doubly terminated crystals of scapolite, weighing from 12 to 30

lb., were found. Phlogopite and zircons, some of them twinned, occur at the same locality. From the enormous size of all the crystals found in this county it must take rank as one of the most remarkable mineral localities known. When the vein 20 feet wide, spoken of above, was discovered, a doubly terminated crystal of apatite, weighing 500 lb. and bright upon the surface and ends, was said to have been found."¹ See also under titanite.

¹ Pro. Min. Section, Ac. Nat. Sciences, Philadelphia, Sep. 27, 1880.

SPINEL. "On the tenth lot of the first range of Burgess the flesh-red Laurentian limestone abounds in crystals of black spinel, which may be traced over an extent of a mile or more. The crystals are sometimes an inch or even two inches in diameter, and are occasionally coated with mica, though often brilliant, and exhibiting a replacement of the edges of the octahedron." Ross township, in imperfect crystals with fluor-spar and apatite in crystalline limestone. The mineral is also found at numerous other localities in the Laurentian. See also gahnite.

SPODUMENE. " . . . in a small rolled mass of granite near Perth."

STAUROLITE. "According to Dr. Bigsby . . . it occurs in the gneiss to the north of lake Superior . . . where it is abundant in very small crystals on Rainy lake and in much larger crystals on the river Lacroix, at the second portage from the lake of the same name."

G. C. p. 498.

STEATITE. Blythfield; Clarendon 14 H; Elizabethtown; Elzevir; Grimsthorpe; Kaladar 5 I; island in Rideau lake; Thunder bay. See also rensselaerite.

STEPHANITE. Badger mine, Port Arthur district.

STIBNITE. Is said to occur near Echo lake and Garden river.¹ Barrie 21, 22, 23 VIII; Marmora; Sheffield 28 I.

¹ R. Com. p. 30.

STILBITE. "This mineral with heulandite and chabazite is said to occur in some of our trappean rocks, but nowhere in distinct and well characterized examples."

Chapman, Min. and Geol. p. 112.

STILPNOMELANE. Madoc 12 V, variety chalcodite.

STRONTIANITE. Nepean 31 A.

CO ₂	30.54
SrO ..	65.43
CaO	3.38
Insoluble	0.17
	99.52
Sp. gr. at 15° C.	3.704

G. S. C. 1892-3, p. 23 R.

SULPHUR. This substance occurs sparingly in the simple state in the Province; chiefly as an efflorescent crust on decomposing pyrites. It is also at times deposited as an incrustation around springs, as in Charlotteville 3 XII. It is also found in the form of minute crystals and in earthy coatings on some of the thin bedded limestones around Niagara Falls and elsewhere. Denbigh 3 V, in quartz from pyrite.¹ North Burgess 2 V.²

¹ G. S. C. 1892-3, p. 27 R.

² G. S. C. 1896 R.

SYLVANITE. Moss H 1, Huronian mine.

TABULAR SPAR. See wollastonite

TALC. Blythfield, near Calabogie lake; Clarendon 24 H; Elizabethtown, near the town of Madoc; Kaladar 8 I; Grimsthorpe 8, 9, 10 V. See also steatite.

SiO ₂	60.45	MgO	29.84
Al ₂ O ₃	0.27	H ₂ O at 100° C.	0.32
Fe ²⁺ O ₃	0.78	H ₂ O above 100° C.	5.42
FeO	2.04		
NiO	0.50		99.78
CaO	0.16	Sp. gr. at 15° C.	2.65

G. S. C. 1892-3, p. 18 R. B. M. 1893, pages 99 to 102.

TANTALITES. See columbite.

TELLURIUM. This element occurs in two Ontario minerals, namely, sylvanite and hessite, the localities of which have already been given.

TENNANTITE. Barrie 6, 7, 8, 9 IX.

TETRAHEDRITE. Silver Islet; Madoc, Empire mine.

G. S. C. 1866-9, p. 168.

THOMSONITE. "Thomsonite of red color, compact and fibrous, often banded with green in a number of concentric rings, is found on the northern shore of lake Superior. . . . The pebbles vary in size from one-eighth of an inch up to one inch across, and are quite extensively sold on all sides of the lake as an ornamental stone. The pebbles when polished find a ready sale among tourists who visit that region. The green which Peckham and Hall described as lintonite, an uncrystalline green variety of thomsonite, often forms the centre or band,

making an effective gem stone, and is sold for the same purpose." Gargantua and Point Mamaine.

G. S. C. 1887-8, p. 78 S.

TIN. This metal occurs as the oxide associated in small quantities with sperrylite in the Vermilion mine, Denison. Specimens of cassiterite have been collected by Mr. G. R. Mickle and others in the vicinity of lake Wahnapiatae. Tin also occurs in small amounts associated with the mineral columbite from the township of Lyndoch.

TITANITE. This mineral has already been referred to under the name of sphene. As the following note is of some economic interest, and is written by the well-known gem expert, Mr. G. F. Kunz, it was thought well to add it here.

"The titanites of Canada have a world-wide reputation, not only for their color, polish and the perfection of the crystals, but also for their great size. A twin crystal of this mineral has been found on Turner's island, in lake Clear (Sebastopol), weighing 80 lb. They are found abundantly in this region, associated with apatite. The crystals are generally of such deep brown color as to appear black, and it is rare that even a small transparent gem could be cut from them. As crystals, however, they are unexcelled, and many thousand dollars' worth have been sold as specimens. The finest are in Renfrew county, especially in Sebastopol and Brudenell townships. Yellow crystals have not been observed as yet."

G. S. C. 1887-8, p. 77 S.

TITANIFEROUS IRON ORE. See under magnetic.

TITANIUM. As a constituent of certain iron ores this element occurs abundantly in the Province. It is also a constituent of sphene.

TOURMALINE. Occurs in many localities among the crystalline rocks. "Fine crystals, rich yellowish or transparent brown in color, often occur imbedded in a flesh-red limestone, in the township of Ross. . . . These furnish an occasional gem."¹ Black tourmaline or schorl is found at a large number of localities, some of which are the following: Charleston lake, Leeds county; Blythfield, near High Falls; Bathurst 18 IV. "Crystals are met with [here] an inch in diameter, having finely modified terminations"; Yeo's island, one of the Thousand islands; Madoc; North Elmsley; Ross 27 III. See also indigolite.

¹G. S. C. 1887-8, p. 67 SL. ²G. C. p. 492.

TRAVERTINE. Onocida, with gypsiferous rocks. See also calcareous tufa.

TREMOLITE. Abundant in crystalline limestone, as in the vicinity of the village of Sharbot lake, and elsewhere.

In the report of the Geological Survey for 1898, p. 53 R, the following localities are mentioned: Bathurst 26 XII: Blythfield 22, 23 IV: Clarendon 37 VII: Ross 23 IV. Good specimens also come from Bagot, Lake and North Burgess.

TURGITE. Madoc; North Burgess.

URACONITE. See uran-ochre.

URALITE. This substance, which is of secondary origin, is recognized in many rocks.

URANITE. See uran-ochre.

URANIUM. See uran-ochre and coracite.

URAN-OCCHRE. Madoc 11 V, the mineral lines fissure in magnetic iron ore: Snowdon, lining minute cavities in magnetite. Uranium is also present in other magnetites, non-titaniferous, in eastern Ontario.¹ See also coracite.

¹B. M. pp. 232-3, 1897.

VANADIUM. Occurs in small amounts in titaniferous magnetites.

VESUVIANITE. Is found in crystalline limestones in different places in the eastern part of the Province. Bedford: Clarendon.

WAD. Madoc 4V; Thunder bay, northeast shore, mixed with iron ochre.

Fe ₂ O ₃	33.68	H ₂ PO ₄	trace
Mn ₂ O ₃	16.54	H ₂ O	3.82
MnO	5.08	Rock matter	36.12
CaO	0.81		
CO ₂	3.78		
H ₂ SO ₄	trace		99.83

Chapman M'n. and Geol., p. 88.

WATER. See mineral waters.

WERNERITE. See scapolite.

WHARTONITE. Blezard 2 II.

The nickel-bearing minerals blueite, folgerite and whartonite were so named by S. H. Emmons. Journal Am. Chem. Soc. vol. xiv, No. 7 and B. M., 1892, pages 167 to 170. See also Am. Jr. Science, 1893, p. 493.

WILSONITE. Bathurst.

SiO ₂	47.50	Na ₂ O	0.82
Al ₂ O ₃	31.17	H ₂ O	5.50
MgO	4.25		
CaO	1.51		99.97
K ₂ O	9.22		

The mineral also contains traces of manganese, to which its color is probably due.¹ North Burgess 2 IX; Foxton mine, Frontenac county; and numerous other localities. "Wilsonite is found . . . in masses of some size, associated with scapolite. The specimens are beautiful, the minerals often passing into each other. The rich purplish-red color of this mineral, and the fact that it admits of a good polish, make it one of the most interesting of gem stones." ²

¹ G. C. p. 483.

² G. S. C. p. 798, 1887-8.

WITHERITE. Gillies, Porcupine mine.

WOLFRAMITE. The only occurrence of this mineral known in Ontario is that in which it was found by Prof. E. J. Chapman in a boulder of gneiss on the shore of Chief's island, lake Couchiching, near Orillia. The mineral was associated with magnetite.

Tungstic acid.....	73.45	Silica	0.20
Niobic acid (?)	1.95		
Ferrous oxide.....	9.05		100
Manganous oxide (by dif-		Sp. gr	6,938
ference)	15.35		

Can. Journal, 2nd series, vol. i. 308, and vol. v. p. 303.

WOLLASTONITE. Fibrous wollastonite occurs in many of the crystalline limestones in eastern Ontario, mixed more or less intimately with mica, pyroxene, quartz and other minerals. North Burgess.

XENOTIME. Calvin.

G. S. C., 1896, part R.

YENITE. See lievrite.

ZEOLITES. Minerals of this group are found in well defined specimens in the amygdaloidal traps of lake Superior, and in a few other places in the Province. They also occur as microscopic individuals in many rocks.

ZINC. See under sphalerite.

ZINC BLENDE. See sphalerite.

ZIRCON. The twin zircons of the township of Sebastopol are well known, and some specimens have sold for high prices. Brudenell; near the village of Bancroft, in nepheline syenite; Pic island, lake Superior, in a syenite rock; Sebastopol 31X, twin zircons. This last locality is referred to by W. E. Hidden in the Am. Jr. Science, June, 1881, and by A. E. Foote in Proc. Min. Section Philadelphia Ac. Nat. Science, Sept. 27, 1880, and Jan. 24, 1881.

ZOISITE. A secondary constituent in many rocks.

ZONCHLORITE. "It occurs in small rolled masses and in the rock at Nipigon bay, and was described by Dr. A. E. Foote. It is a dark opaque green stone, beautifully marked and veined, and admitting of a high polish, and ought to find some sale as a local or tourists' gem."

G. S. C., 1887-8, p. 778.

A SKETCH OF THE NICKEL INDUSTRY.

By J. W. Bain.

During the past ten years Canadians have awakened to the fact that, together with mines of gold, silver, copper, lead, zinc and iron, they possess valuable mines of nickel—one of the less common metals—and have discovered at the same time that only in one other part of the world are to be found large stores of this metal. Public enlightenment has been due to an amendment of the Mines Act, which aims to provide for the refining of all domestic nickel ores in Canada. At present the ore is mined and simply concentrated before export, and the reduction of the crude nickel to fine metal is conducted almost entirely in the United States. There has been a good deal of discussion in the columns of the daily press, as may well be supposed, over the taxation on crude nickel, and the editorial deliverances have been reinforced by a series of controversial letters from some of those who are financially interested in the affair. Information on the subject is scarce and not easily accessible, and in view of the discussion which has been carried on the following outline of the metallurgy of nickel may be interesting and useful.

SOURCES OF NICKEL ORES.

Nickel has been discovered in greater or less abundance in many parts of the world, but only the more prominent deposits can be mentioned here. Small quantities of the arsenides and sulph-arsenides of nickel are found in some of the well known metalliferous lodes of Germany and Hungary. As a rule, the nickel may be regarded as a bye product in the reduction of these ores, although a valuable one, and the proportion of the metal to the rest of the ore is very low. Norway, Italy, the United States and Canada possess deposits of nickel sulphides, the Canadian only being sufficiently valuable to work.

The Norwegian deposits, consisting of nickeliferous pyrrhotite and pyrite, are found chiefly at the contact of massive gabbro with schists. The ore bodies are almost pure pyrrhotite surrounded by gabbro impregnated with the sulphides which, in passing outwards, gradually decrease in amount until finally they disappear. There are small bodies of rich ore averaging 7 per cent. nickel, and the better mines can get 3.5 to 4 per cent., but the grade of the bulk is much lower. In 1870 miners were satisfied with 0.5 to 1.3 per cent. nickel from the smelting ore, but in later years, when only rich mines have been operated and hand sorting has been practised with more care, the yield has increased from 1.4 to 2.5 per cent., averaging 2 per cent.

For a number of years a considerable quantity of ore was mined, which reached a maximum in 1876 with a product of 42,550 tons. Since then the following quantities of pure nickel have been produced :

1876.....	360 tons.
1877-80	100 “
1881-85.....	125 “
1886-92.....	105 “

At Lancaster Gap, Penna., there is a deposit of nickeliferous pyrrhotite which was worked for a number of years, commencing in 1862, by Joseph Wharton of Philadelphia. The ore is reported to have carried 1.5 to 3.6 per cent. nickel and 0.75 per cent. copper ; a considerable quantity of nickel was produced, aggregating, it is said, 2000 tons. The mine has not been operated for some time.

Nickel silicates are found in New Caledonia, and in Oregon and North Carolina, United States. The latter deposits are small and give no promise of future development ; as far as can be gathered, the total quantity of ore which could be mined is insignificant.

The presence of nickel in New Caledonia was pointed out by Garnier in 1867, but not until 1873 were the mines opened and shipments made. Geologically, the southern and eastern portions of the island are large areas of massive serpentines, in the centre of which occur the deposits of nickel. In the serpentines are found depressions filled with large bodies of clay, which have probably been formed by the decomposition of the surrounding rocks. The presence of nickel is explained in the following way : After the formation and hardening of the clay, springs broke out which corroded the serpentines at their contact with the clay, and in these channels were then deposited from solution iron and nickel ores. Whether this be the true explanation or not, the nickel ore is always found at or near the contact of the clay with the enclosing serpentine, either in pockets or in small veinlets (stockwork) traversing the mass in all directions.

The ore is a hydrous silicate of nickel and magnesium known as garnierite, of a beautiful apple-green colour when pure. It is said to average 10 per cent. nickel after sorting, with serpentine as gangue. There are two companies operating: Le Nickel, and Le Société d'Exploitation de Mines de Nickel. The former, which is the larger, has smelters at Havre and buys all the nickel ore produced in New Caledonia. A large English company has recently entered the field.

The mining is carried on in a rather crude fashion, mainly by large quarries. The ore is simply broken down after the covering of red clay has been carefully stripped, and then sorted by hand into rich and poor qualities—the former containing 8 per cent. of nickel and over, the latter less. The waste, still containing 3 to 4 per cent. nickel, is thrown aside as worthless. Where much red clay is found the ore is washed, but this can only be done roughly on account of the loss which takes place. Some of the larger veins in hard rock are worked by incline and overhand stopes, but the walls are irregular and may easily be lost in driving levels. The ore is transported usually to the seaboard by aerial tramways and by carts, at a cost varying from 10 cents to \$2.00 per ton. The mines are all situated within a few miles of the sea so that no long hauls are necessary, but shipping facilities are poor. Those deposits which lie far inland are not worked at all. The ore is carried for ballast very cheaply by vessels during the wool-shipping season.

A mining engineer who is familiar with the country states that "European buyers generally pay about 75 centimes per kilo ($6\frac{1}{2}$ cents per pound) nickel contained in the ore (with a minimum of 7 per cent.), delivered in barges alongside the loading vessel. Freights by sailing vessels vary from 32 to 34 shillings (\$7.78 to \$8.26) per ton to Glasgow, Havre or German ports. Provided a minimum of 7 per cent. has to be maintained, I doubt very much whether the production will exceed 60,000 to 70,000 tons per annum, but with a lowering of the nickel contents to say 5.5 per cent, the production could be more than doubled."

The Engineering and Mining Journal of May 20, 1899, notes that a cargo of 3000 tons New Caledonia ore is being sampled for the Orford Copper Co., the ore averaging 7 per cent. nickel. The cost f. o. b. in New Caledonia was 30 shillings (\$7.50) per ton, and the freight to England 38 shillings (\$9.50), so that the total cost would be about \$17 per ton in New York.

Some of the miners are Englishmen at \$1.20 to \$1.80 per day, others are Kanakas at \$4 00 per month and board, but the majority are convicts obtained from the Government on contract.

	Production (metric tons).	Exports.
1890.....	32,000	.....
1891.....	33,000	.....
1893.....	69,614	45,614
1894.....	61,243	40,089
1895.....	29,623	38,976
1896.....	6,417	37,467
1897.....	29,464	57,439
1898.....	74,614	74,614
1899.....	.....	101,908

Returning to our domestic supply, we find that a body of copper ore was discovered in a railway cutting during the construction of the C.P.R., about four miles northwest of the town of Sudbury. The district is exceedingly rough, and, before the advent of the railroad, accessible only with difficulty, so that the prospectors and explorers had either been deterred by the magnitude of the task of exploration or had thought that valuable deposits of ore probably did not occur. When the first discovery had been made, however, others followed in rapid succession, and before long several companies were at work. One of these, the Canadian Copper Co., shipped a car load of their ore to be smelted, and it was then discovered that nickel was present in such quantity as to make the ores far more valuable for that metal than for copper. A sketch of the growth of the industry from these beginnings would form a lengthy paper, and it can only be said that the growth has been rapid, yet of that solid character which is of so much importance to the country at large.

The ores themselves are either chalcopyrite or pyrrhotite, or far more commonly a mixture of these two. The chalcopyrite is often found of a fair degree of purity in pockety masses in the mixed ore, while vast bodies of pyrrhotite with little or no chalcopyrite are found here and there in the district. Associated with these common minerals

are small quantities of those which contain nickel as an essential constituent, such as millerite, pentlandite and others which contain large percentages of the metal and thus raise the general richness of the mass. The nickel appears to be present in the pyrrhotite of these ores replacing some of the iron; it is variable in quantity, but usually forms about three per cent. of the ore. Occasionally richer masses, in which may be discovered often the nickel minerals above mentioned, are found yielding as much as eight or nine per cent, but these bonanzas are not very common. The smelting ore during the last seven years has averaged 2.51 per cent. nickel and 2.92 per cent. copper.

The world's production of nickel in metric tons is shown as follows for the last seven years, as published in volume VIII of the Mineral Industry.

Year.	New Caledonia.				Ontario.	Norway.	United States.		World's total.	Ontario's percentage of total.
	Prussia.	France.	Eng-land.	Total.			Domes-tic.	Import-ed.		
1893..	893	1,600	.....	2,493	1,807	113	11	1,320	4,424	40.8
1894..	522	1,545	355	2,422	2,226	103	4	1,920	4,755	46.8
1895..	698	1,545	305	2,548	1,764	17	5	1,220	4,334	40.7
1896..	822	1,545	406	2,972	1,541	16	8	1,685	4,537	33.9
1897..	898	1,245	715	2,858	1,813	nil	15	1,859	4,686	38.7
1-98..	1,108	1,540	960	3,608	2,503	(a)	5	3,234	6,116	40.8
1899..	(a)	(a)	(a)	(a)	2,605	(a)	10	3,651	.....	.....

(a) Statistics not yet reported.

The following table gives in metric tons the nickel production of Ontario for six years, according to the reports of the Bureau of Mines and of the Geological Survey, but there are discrepancies in the figures of the first three years.

Year.	Reported by Ontario Bureau of Mines.	Reported by Dominion Geolo- gical Survey.
1894	2,331	2,226
1895	2,099	1,764
1896	1,766	1,541
1897	1,813	1,813
1898	2,525	2,503
1899	2,605	2,605
Total	13,139	12,452

REFINING NEW CALEDONIA ORES.

A number of methods for the extraction of nickel from these ores have been tried at various times and places. Garnier, who has taken a prominent place in connection with this industry, endeavored to smelt the ore directly to a nickeliferous pig iron which would afterwards be refined in reverberatory furnaces. Difficulties in the last stage, however, led to the abandonment of the process. Wet methods varying slightly in detail have been used in several metallurgical works; these follow on a large scale the operations of a chemical analysis. The ore is dissolved in acids, the other metals are successively removed by treatment with such materials as lime and bleaching powder, and finally a solution containing only nickel is obtained. From this it is easy to produce the metal by fusing with charcoal the dried nickel salt. The method which I believe is used at present is a dry one and may be described as follows:

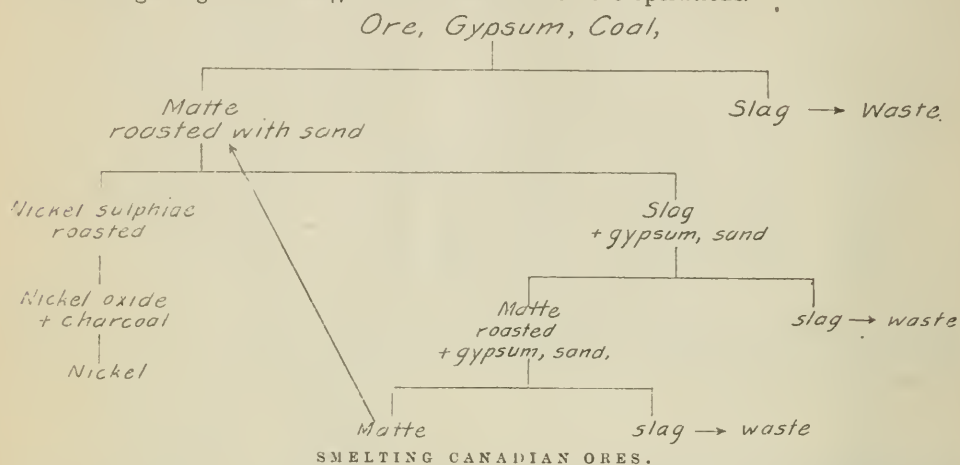
The ore is mixed with gypsum and coal and smelted in low water-jacketed furnaces with the formation of a nickeliferous matte and a slag which is allowed to go to waste. It will be remembered that the ore consists of iron and nickel oxides, magnesia and silica, and in the smelting operation just described the following changes take place. The gypsum, which contains lime and sulphur, is decomposed and gives up its sulphur to that element which is most ready to receive it, in this case to the nickel. After the nickel has satisfied itself with sulphur the remainder is taken up by part of the iron, while silica, magnesia and lime unite with the rest of the iron to form a slag. We have then a mixture of iron, nickel and sulphur, or iron-nickel matte, which by reason of its greater sp. gr. sinks to the bottom of the furnace through the lighter slag, which contains practically none of the valuable metals and is thrown away.

The matte is now roasted and a portion of the sulphur driven off; on smelting with sand the nickel once more appropriates as much sulphur as it requires, leaving the rest to

the iron. Since part of the sulphur has been removed it is plain that the nickel will have the lion's share, and that only a small proportion of the iron will be able to satisfy itself with sulphur. The remainder of the iron unites with the sand to form a slag. We have again a matte, this time very much richer in nickel and poorer in iron, and a slag containing only a small percentage of nickel.

By a repetition of these operations the iron is finally removed, leaving a compound of nickel and sulphur, which is roasted with nitrate of soda to produce nickel oxide. The latter is then mixed with charcoal and exposed to intense heat, resulting in the production of metallic nickel.

The diagram given below gives a concise view of the operations.



The Canadian ores, consisting of chalcopyrite and pyrrhotite with accompanying rock matter, are treated at Sudbury in the following manner :

The ore after coarse crushing is piled in a special manner in heaps upon a foundation of wood; the wood is then fired and almost immediately the sulphur in the ore commences to burn and continues to do so without any further addition of fuel. These piles hold from 600 to 3,000 tons of ore and burn from 6 to 20 weeks, reducing the sulphur contents roughly from 30 to 7 per cent. The roasted ore is then taken to the smelters, which are of the Herreshof pattern, water jacketed and 9 feet high to the charging door. Two furnaces are always in operation, each with a capacity of 125 tons of ore and producing 15 tons of matte per day of 24 hours. Beside each furnace is placed a forehearth or settler into which the matte and slag flow as soon as they are fused in the furnace. There is thus obtained a more complete mechanical separation; a comparatively quiet pond is formed in which the matte can settle to the bottom, while the slag flows continuously over a spout at the top of the well. The matte is tapped at short intervals into conical pots which are wheeled out into the open air to cool. The slag is exceedingly basic and flows with perfect liquidity until, pouring from the slag spout, it meets a powerful jet of water which granulates and sweeps it away to the dump.

In order to understand these operations, it may be well to glance very briefly at the chemical reactions upon which they are based. When the ore, a mixture of iron, nickel, copper and sulphur with silica and rock matter, is roasted in the open air a large portion of the sulphur burns to sulphur dioxide and passes off into the atmosphere; the iron having lost most of its sulphur supplies the vacancy with oxygen from the air, forming oxides, while that portion of the sulphur which it still retains is combined as iron sulphates. The behaviour of the copper and nickel is somewhat similar, but so strong is the affinity of these metals for sulphur that only small portions are changed to oxides, the bulk being sulphates. The gangue is from a chemical standpoint, practically unaffected by the roasting; it is however more or less disintegrated by the alternate heating and cooling, and on that account is the better prepared for the smelter.

When the roasted ore is charged into the furnace the ferric oxide is reduced to ferrous oxide, which combines with the gangue to form a slag, while the nickel and copper retaining their sulphur unite with the remaining iron and sulphur to form a metallic bath

in the bottom of the furnace. This material, consisting as has been said of iron, nickel and copper combined with sulphur, is known as matte; it contains the valuable constituents of the ore with the exception of slight quantities which pass off into the slag.

From the furnaces at Sudbury we have then at this stage two products; a matte, averaging

Copper	20.25 per cent.
Nickel	18.23 "
Iron	25.35 "
Sulphur	26.33 "

and a slag, containing 0.1 per cent. copper and a trace of nickel, which goes to waste. The former material is what is commonly referred to in the press as nickel matte, and at this stage it is shipped to the United States for further treatment.

Analyses of samples of these two products made by the writer are given below.

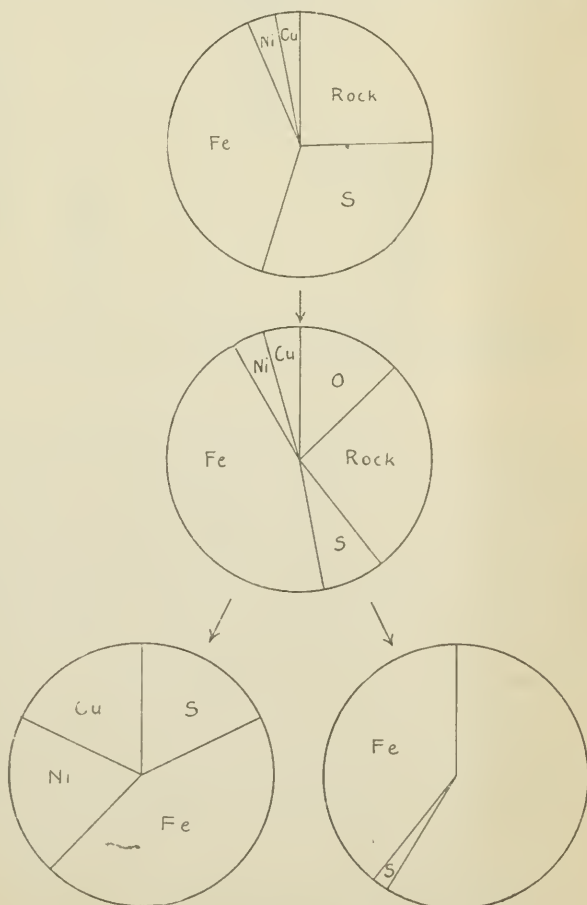
Matte.		Slag.	
Iron	43.90 per cent.	Silica	26.67 per cent.
Nickel	16.75 "	Ferrous oxide	50.82 "
Copper	19.87 "	Ferrous sulphide	3.52 "
Cobalt	0.63 "	Alumina	12.88 "
Sulphur	18.72 "	Lime	3.38 "
Slag	0.05 "	Magnesia	2.95 "
		Nickel	0.10 "
		Copper	0.20 "
	99.92		100.52

The diagram below represents graphically the chemical changes which take place in the treatment of the ore. The uppermost circle represents the composition of the raw ore; the next circle lower, the composition of the roasted ore, which separates into two products matte and slag, whose component parts are shown in the two circles at the bottom. These latter two are simply graphical reports of the analyses given above.

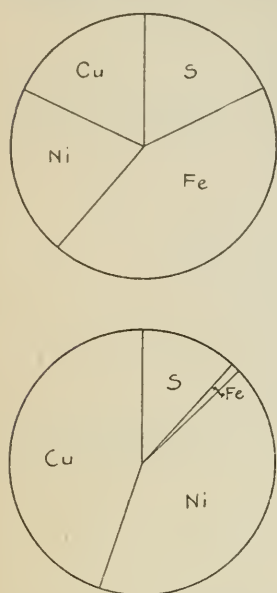
Eight or nine years ago the Canadian Copper Co. refined this ordinary matte still further by a process known as Bessemerizing, which consists simply in forcing a powerful blast of air through the molten material, an operation which causes so violent a reaction that no external heat is required.

The converter used was the Manhès' modification, and had a capacity of one and a half tons with a new lining and three tons with an old lining. The matte was run by troughs directly from the blast furnace to the converter, which was then wheeled to the chimney and the blast turned on. Starting at 5 lb. pressure, a violent agitation takes place, and on raising the pressure to 7 lb. white fumes of sulphur trioxide begin to appear. The color and appearance of the flame are no indication of what is going on in the converter.

The end of the operation is judged rather by a perceptible diminution of the tem-



perature, not only of the flame but also of the particles splashed or blowout of the converter, and by the appearance of these particles which gradually become more frothy and at last issue in flakes about the size of the hand. This usually takes 40 to 50 minutes. The blast is then stopped, a few minutes is allowed for the settling of the metal, and the charge is poured. A lining usually lasts for five to seven blows.



During the operation a large proportion of the sulphur and almost all the iron is removed to form a slag with the siliceous lining, so that a mixture of copper and nickel sulphides containing roughly 80 per cent. of these metals is the product. The amount of nickel oxidized is trifling, the copper and nickel in the slag being invariably present in the same proportion as in the original and final matte, showing that the loss is merely due to grains of matte entangled in the slag. Cobalt is perfectly scorified, with but little oxidation of nickel, which might answer as a commercial method of separation; zinc, arsenic and antimony are completely volatilized; but bismuth, silver and gold are concentrated entirely in the matte. The change in composition during Bessemerizing is shown graphically in the annexed cut, in which the upper circle represents ordinary matte and the lower Bessemer matte.

Analyses of products are given in the following table :

Bessemer Matte. ¹			
Nickel sulphide	63.8	64.7	64.9
Copper	32.4	32.1	33.9
Iron	3.8	3.2	1.3
Slag. ²			
FeO	66.6		67.1
SiO ₂	28.5		27.9
Cu	1.1		0.8
Ni	1.9		1.6
S	0.5		0.4

Bessemer matte.

Cu	43.36	45.71	48.86	44.87
Ni	39.96	40.93	31.35	41.18
Fe	0.30	0.40	0.81	0.94
S	13.76			11.62
Ag	7 oz.			5.1 oz.
Au	0.1 0.2 oz.			0.3 oz.
Pt	0.5 oz.			
	(3)	(4)	(5)	(6)

According to the Canadian Copper Co. this rich matte was not so acceptable to consumers as the other of lower grade, and consequently the Bessemerizing was stopped.

THE ORFORD REFINING PROCESS.

Almost all the ordinary nickel matte of the Canadian Copper Co. is refined by the Orford Copper Co. at Constable Hook, N. J., by what is known as the alkaline sulphide process.

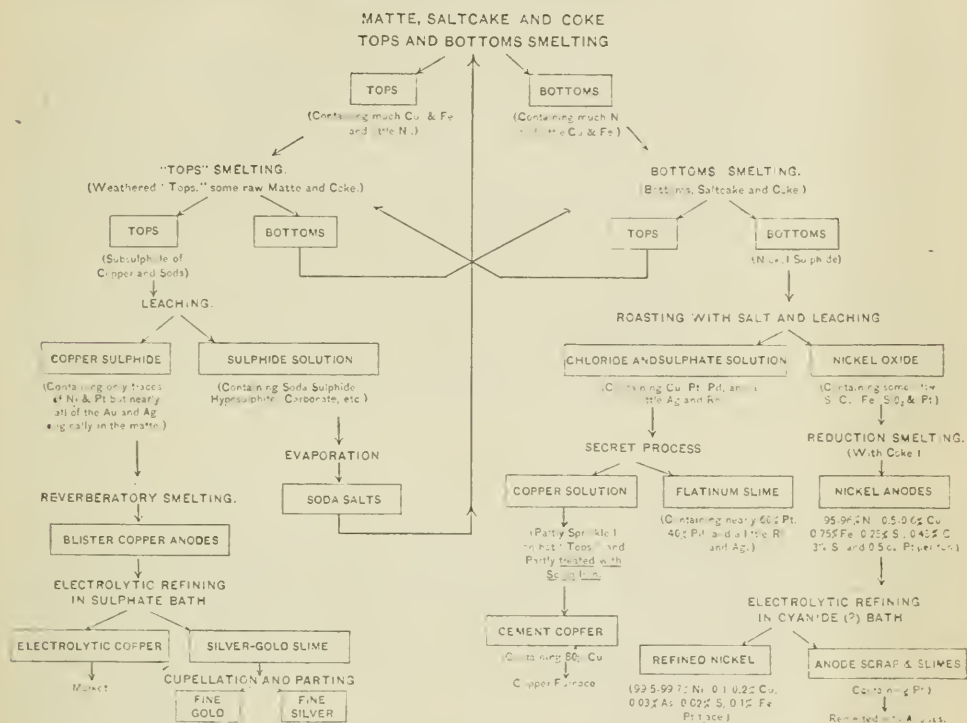
This depends upon the fact that if a fairly rich nickel-copper matte be smelted with sulphate of soda and coal, the sulphides of copper and iron unite with the sulphide of soda produced in the process to form a very fusible mass, while the nickel sulphide which is of greater sp. gr. sinks to the bottom fairly free from the other two metals. Upon cooling there is a distinct line of separation visible, and the nickel sulphide in a yellowish white mass is readily removed from the dark iridescent iron-copper matte. These products are technically known as "tops" and "bottoms."

In practice the matte is smelted with salt cake, or crude sodium sulphate, a chemical which can be obtained cheaply, and two products result; tops containing nearly all the iron and copper as sulphides together with sodium sulphide, and bottoms containing all the nickel with small quantities of iron and copper. The tops are then exposed to the weather and the soda is gradually changed to the caustic condition in consequence. They are then smelted with fresh matte when the soda robs the nickel of part of its sulphur,

¹ Edwards, Eng. and Ming. Journ. May 2, 1896. ² Ibid. ³ Ulke, Min. Ind. vol. iii, p. 449.

⁴, ⁵ Roberts-Austen, Min. Proc. Inst. Civil Eng., vol. cxxxv, p. 30. ⁶ J. W. Bain.

producing once more a fluid mixture of iron, copper and sodium sulphides, while the nickel in a semi metallic state sinks to the bottom once more. By combining these two operations a pure sulphide of nickel with only very small quantities of copper and iron is obtained, which is simply roasted with a little sodium nitrate to produce the nickel oxide of commerce. If the metal be required, the oxide is mixed with some carbonaceous material and ignited; it may afterwards be fused and cast as required. The following diagram of the Orford method was published in the Engineering and Mining Journal of July 3, 1897, accompanying a paper on the subject by Titus Ulke.



DIAGRAMMATIC SCHEME OF THE ORFORD METHOD OF TREATING NICKEL-COPPER MATTE.

The origin of the alkaline sulphide process has been the subject of some dispute recently, one party claiming that it has been invented but a short time, while the other holds that it is of much earlier date. Some English patents of fifty years ago are interesting in this regard, and a few notes may find a place here.

Charles Schafhautil, in Patent 7994, issued September 5th, 1839, describing an improved method for smelting copper ores, makes the following statement: "I claim as part of my invention, firstly, the mixing of the ore with bodies of an alkaline nature which have an affinity for sulphur in order to decompose the sulphurets, or of mixing the same alkaline bodies and carbonaceous matter to decompose the carbonate of copper or the mixing the ore or metal to be calcined, roasted or smelted with carbonaceous matter—particularly plumbago or anthracite—and the said mixture of alkaline bodies and carbonaceous matter when the scoria or slack contains oxide of copper, and a mixture of carbonaceous matter and sea sand when the scoria or slack contains oxide of copper and metallic copper." In the case of ores containing 5 to 12 per cent. of copper, five parts were mixed with two and a half parts of quicklime and salt. The whole was then treated in a patent-calcining furnace and the product leached; the residue was then smelted again. From the description it is plain that the inventor had found that a good deal of iron could be removed in this way, and probably in treating a nickel-copper ore he would have noticed that the copper would commence to pass into the supernatant

matte before the nickel. There is, however, no reference in the specification dealing directly with this point.

William Jeffries, in Patent No. 8557, dated January 1st, 1841, describes an improved method of treating copper ores in a reverberatory furnace by the addition of anthracite or common soda. His process does not appear to have any unusual feature, and the function of the alkali is somewhat indefinite.

William Gossage, in Patent No. 10,976, dated June 4th, 1846, gives an account of his improvements in the method of copper smelting: "The sulphureous ores and compounds of copper from which I obtain metallic products by the use of my invention are such ores and compounds as contain other metals than copper, such as tin, bismuth, lead, nickel and silver, or some of these." Hitherto copper had been purified by smelting such ores to bottoms too impure to be worked. "If the said 'bottom copper' does not contain such a proportion of silver as makes it desirable to proceed at once to the extraction of silver therefrom, I melt this with such a quantity of sulphureous ore or compound of copper as will yield sufficient sulphur to convert the 'bottom copper' into sulphuret, and I thereby obtain a sulphuret containing copper and other metals combined with sulphur, and I subject this sulphuret to such operations as are commonly used for obtaining 'bottom copper' and 'regulus' from sulphuret obtained from ores and compounds in the ordinary way. I thus obtain from such 'bottom copper' a certain portion of the copper (previously contained therein) in a state of sulphuret nearly free from admixture with other metals; also a new production of 'bottom copper' containing copper in a metallic state, combined with a larger proportionate quantity of other metals." There is here a definite scheme for the separation of nickel from copper by a smelting process, but it relies upon the addition of sulphureous ore instead of an alkaline material to supply the sulphur required.

That the alkaline sulphide process was in use previous to the entry of the Orford Copper Company into the field of nickel smelting is proven by a letter published in the Engineering and Mining Journal in August, 1893, from an ex-employee of the Vivian Company at Swansea, stating that the method had been employed for a number of years at that company's works. The separating furnace, a reverberatory, was charged with 3000 pounds of a mixture of salt cake, coal and matte; after smelting, the slag and tops were skimmed from the bottoms, locally known as "white." The slag and tops contain the copper, iron and other impurities, and the "white" is free from these. Pure nickel oxide free from copper was made at the works, but most of the shot metal was alloyed with copper according to the grade.

The Orford Copper Company were led to adopt the alkaline sulphide process by some experiments made on a small scale by their metallurgists, and great credit is due to them for the manner in which they have worked out the details. The following account of it has been supplied to the Bureau by Mr. Robert M. Thompson, the President of the Company:

"The United States Government purchased from the Canadian Copper Company a large amount of copper-nickel matte which was sent to my works to be refined. At that time we were not nickel refiners, but my relations with the navy were such, having formerly been a naval officer, that I was willing to do anything in my power to oblige them, so I set all my chemists and experts at the task of working out a process which would treat this matte. We started a process which did give us a product that the steel-makers could use, but which we found to be unsatisfactory and so costly that we were in despair. One day when visiting the works I noticed some pots of matte cooling in front of the furnace and observed that it had a different appearance from any I had ever before seen. I asked the superintendent what was the cause of it; he thought there was no reason, that it was a mere accident, but on appealing to the foreman he confirmed my belief that this matte was something different from anything before produced. The bottom of the cone was yellow, and the top was black. I had samples taken of each part and examined, and found that there was a concentration of nickel in the bottom and of the copper in the top. I then made an investigation, and found that the chemical department had had a cleaning out, and that a lot of residues had been thrown on the matte pile and put through the furnace, which was the means we used of getting rid of our waste products. I then examined my books for a period of a year to see what chemicals

had gone into the chemical house, and an investigation was started by my superintendent, Mr. John L. Thompson, and his assistant, Mr. Charles Bartlett, in which we tried experiments with all the chemicals known to have gone into that department. Finally we found the material which effected the separation. From this beginning a long series of experiments conducted on a large scale gradually worked out the process now known as the Orford process, which is to-day producing nickel as high as 99.7 fine. This is a brief history of our process."

THE BALBACH PROCESS.

The nickel produced by its own process at the Orford Company's works is not yet sufficiently pure for certain purposes, and some of the crude metal is sold to the Balbach Smelting Works, N. J., where it is further refined by an electrolytic process which remains a trade secret. The discovery of a satisfactory method for depositing nickel for the purpose of purification has been the object of much research. It is easy to plate a thin layer of the metal, but as the thickness increases a tendency to strip is noticed, and it becomes impossible under ordinary conditions to obtain coherent sheets suitable for rolling or working. This difficulty has been overcome at the Balbach works by some unknown method which Ulke, an authority on the subject, believes to consist in the use of a heated neutral solution of nickel sulphate for the electrolyte. It is well known that apparently trivial variations in electrolytic work produce results which appear to entirely incommensurate with the changes, and the working out of a commercial process is often dependent upon a happy combination of material. The Balbach Co. have produced plates of nickel 20" x 30" and $\frac{3}{8}$ " thick, which are so tough and elastic that they are as troublesome to work as so much tempered steel. The anode scrap may amount to 40 per cent. of the charge.

THE HOEPFNER AND FRASCH PROCESSES.

In the latter part of 1899 it was announced that a strong company under the title of the Hoepfner Refining Company, with a capital of \$10,000,000, had been formed in Hamilton to refine nickel-copper mattes and zinc ores. These metals were to be obtained by electrolysis, using methods which had been developed by Dr. Carl Hoepfner, and a description of his cuprous chloride process may be of interest.

The basis of the Hoepfner method is the employment of chloride instead sulphate or cyanide solutions, and for the chloride process Dr. Hoepfner makes among others the following claims:

That they are better conductors of the current and are commercially cheaper. That they are applicable to the extraction of precious metals. That they prevent the deposited metal from becoming contaminated with sulphur. That they allow for the purification of the solution and its maintenance perfectly free from iron, arsenic, antimony, bismuth, etc.

A heated solution of cupric chloride containing 60 grams of copper per litre, and saturated with sodium chloride or calcium chloride, is passed into leaching drums containing the ore ground to 90 mesh, and is allowed to act for from two to six hours according to the nature of the material.

The operation takes place in two stages, thus: A fresh solution of cupric chloride is added to a drum of ore which has previously been treated in order to extract any of the remaining metals, and it then passes to a drum containing fresh ore where it is reduced to cuprous chloride. It is then drawn off, leaving a residue which in good practice does not contain more than 0.2 per cent. copper. The solution, now cuprous chloride, is run into vats and the impurities are separated; silver by finely divided copper; lead by cooling; arsenic, antimony, bismuth and iron by oxide of copper or by lime.

The solution then passes in two streams to the depositing bath, which are so arranged that the electrodes are immersed in the two portions of the solution. Copper is deposited on the cathodes until the solution is entirely or almost entirely exhausted; while at the anodes chlorine is liberated which re-converts the cuprous to cupric chloride.

These two streams flow into one common tank, and by their mixture we obtain once more a solution of cupric chloride with 60 grams copper per litre. The solution, now

purified from metals which would interfere with the next operation, is made neutral or is acidulated with some weak acid such as citric or phosphoric, and electrolyzed with the production of pure nickel. The anodes are insoluble, and are separated from the cathodes by nitrated linen or cotton mixed with asbestos; the cathodes are rotating vertical or horizontal discs, with brushes.

It will be seen that the common trouble due to the unequal decomposition of the mattes and their consequent crumbling is entirely absent in this process. A curious advantage possessed by the Canadian ores over other nickel ores is due to the presence of small quantities of the precious metals. Thus a ton of Bessemer matte from the Canadian Copper Co.'s furnaces contains on an average 7 oz. silver, 0.1—0.2 oz. gold, and 0.5 oz. platinum, worth at current prices \$16. These metals, it is claimed, are entirely recovered by the Hoepfner process and constitute one of the valuable by-products.

The supply of nickel-copper matte was to be obtained from the Nickel-Copper Company, Limited, which had been organized with the following officers: A. T. Wood, President; John Moodie, Treasurer; and John Patterson, Secretary, to mine and smelt the Sudbury ores; but unfortunately the Hoepfner Company were not able to carry out their refining process with commercial success, and the Nickel-Copper Company took the matter into their own hands. The services of Mr. Hans A. Frasc were obtained and after experimenting for some time, he devised a process which is said to be at once efficient and cheap. On the 3rd September the Company announced that a public exhibition would be given, and a number of prominent men were invited to attend. Among these was Mr. Joseph Struthers of the staff of the Mineral Industry, who made a thorough investigation of the process and supplied a description which was published in the Engineering and Mining Journal of September 8, 1900. Mr. Struthers is a thoroughly competent metallurgist, and the details which he supplies may be fully relied on. The following description has been compiled from his article.

The process is based upon the electrolysis of a solution of common salt in the presence of the matte which is to be treated. As is well known the salt under the influence of the electric current is gradually decomposed into its elements, sodium and chlorine, the former reacting immediately with the water to form sodium hydrate, commercially known as caustic soda, while the latter, in the absence of any material with which it can combine, bubbles to the surface and can be drawn off in pipes. The matte, however, is readily attacked by chlorine, with the formation of chlorides of the metals which it contains, and this affords a ready method of dissolving the valuable constituents of the material under treatment.

In the electrolytic cell in practice, the matte, coarsely crushed, is placed upon the anode, which consists of a layer of carbonaceous material in the bottom of the vat. A layer of sand covers the matte and forms a diaphragm for the separation of the solutions of caustic soda and the chlorides of the metals. The bottom of the vat is filled as far as the sand layer with a chloride solution, and water is added to fill the upper portion. As electrolysis proceeds the chlorine attacks the metals of the matte forming a solution of chloride which remains below, while the caustic soda solution is to be found above the layer of sand. It is claimed that the caustic soda and other by-products will be sufficiently valuable to meet the entire expense of the process. The copper and nickel are to be removed successively from the solution by electrolysis.

An interesting feature is the proposal to use to the cupric chloride solution from the electrolytic cell for the treatment of new parcels of matte in precisely the manner described above in the Hoepfner process. At the public exhibition the solution of the ore was exhibited in an experimental plant, but the process has not yet been tested on a commercial scale. In addition, all reference to the most difficult problem, the deposition of the nickel, has been avoided in the published description, and until further work has been done it will be advisable to suspend any opinion.

THE LAKE SUPERIOR POWER COMPANY'S PROCESS.

It is commonly known that some American capitalists have invested a good deal of money in hydraulic works and pulp mills at the Canadian Sault Ste. Marie. For some time they were content to produce mechanical pulp, but finding that a good market

existed for sulphite pulp it was decided to enter upon its manufacture. For the production of this pulp it is necessary to use sulphur, and an inspection of the sources of supply led to some experiments with the nickeliferous pyrrhotite of the Sudbury region. It was found that the latter material on roasting gave a satisfactory quantity of the sulphur dioxide required, while there remained behind a mixture of iron and nickel containing still 7 per cent. of sulphur. This residue was mixed with lime and charcoal and smelted in electric furnaces with the following results :

In one case the mixture was contained in a vessel which acted as one electrode, the other being a carbon pencil moving perpendicularly ; the product in this case consisted of 40 per cent. nickel, 28 per cent. iron, 12 per cent carbon and no sulphur.

In another instance the electrodes were placed side by side with a bridge between them, forming a continuous furnace which reduced the ore as fast as one man could shovel it in. In this case the material contained 7 per cent nickel and was high in carbon, and so hard that it offered great advantages as a cutting tool.

The company propose to enter upon this process commercially, and expect within a short time to produce daily 200 tons of ferro-nickel and to employ this alloy for the production of nickel steel rails at the rate of 500 tons per day.

PURITY OF NICKEL.

The purity of the commercial nickel in the market has steadily increased since its introduction, and a metal containing only very small amounts of impurities can now be obtained without difficulty. This will be made plain by a comparison of the table of analyses appended with that published in the Mineral Industry vol. I, p. 349. The analyses quoted below give the composition of some of the specimens of nickel on the market, with the exception of No. 7 which is a hitherto unpublished analysis of a bar of Wharton's nickel.

	1	2	3	4	5	6	7
Nickel	98.89	98.80	98.80	99.80	99.82	99.43	98.76
Carbon	0.40	0.16	0.16	0.05	0.07	0.087	
Silicon	0.02	0.09	0.09	none			0.26
Copper	0.10	0.11		none			0.10
Iron	0.43	0.60	0.60	0.13	0.10	0.43	0.91
Cobalt	0.14			none			
Manganese.....	0.02						
Sulphur		0.016	0.016	0.006	0.0068	0.0099	tr.
Tin		0.11					
Arsenic.....		0.11	0.11				none
Insoluble Residue						0.026	

1. American nickel, analysis by Foerster quoted by Ulke, Min. Ind. vol. vi, p. 505.

2. Cubes, Ferro-nickel Co., Inst. Civil Eng., 28 Mar., 1899.

3. Thompson nickel, Inst. Civil Eng., 28 Mar., 1899.

4. Mond nickel, Inst. Civil Eng., 28 Mar., 1899.

5. 6. Mond nickel, Proc. Inst. Civil Eng., Nov. 8th, 1898.

7. Wharton nickel, analysed by J. W. Bain.

USES OF NICKEL.

Nickel is used chiefly in the production of nickel-steel, a material which has come rapidly into favor on account of its excellent qualities. Much has been written during recent years concerning this new steel, and it would far exceed the limit of this paper to give an adequate account of the discussion. Two excellent contributions to the subject were made in 1899 by R. A. Hadfield¹ and David H. Browne² and many details will be found in these papers.

Nickel-steel has many uses and is daily being tried for new purposes. Perhaps the most important use to which it is put is for the manufacture of armor and heavy

¹Proc. Inst. Civil Eng. Mar. 28, 1899.

²Trans. Am. Inst. Mng. Eng. Sept. 1899.

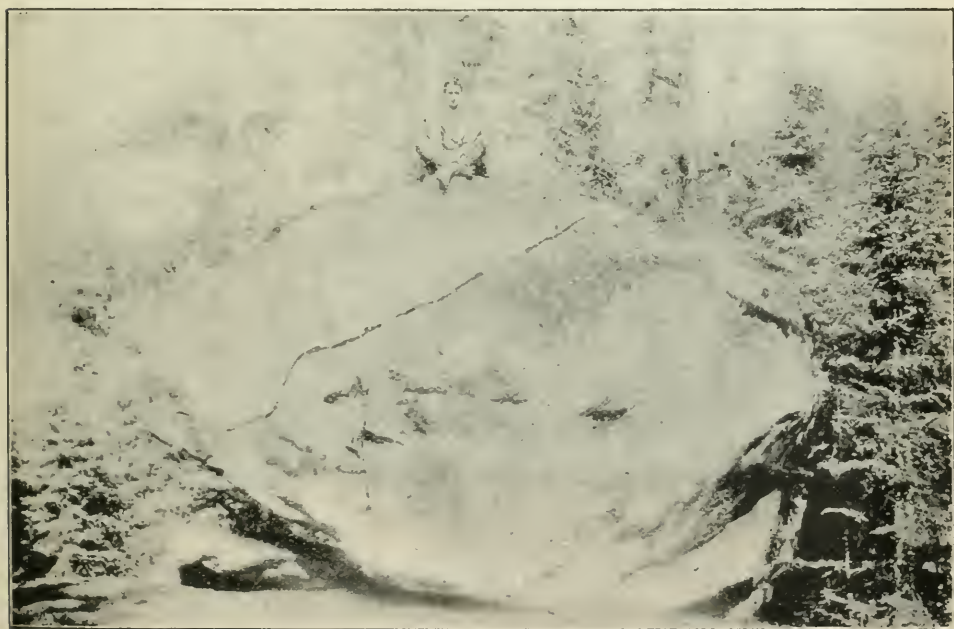
ordnance, where its great strength and toughness are of much value. It has been used for engine and propellor shafts for a number of years, and has proven so much superior to other steels that it is unrivalled for such purposes. Because of increase of strength or decrease of weight, it has been used for piston rods, crank pins, light forged engine frames, bolts for extreme hydraulic pressures, hydraulic forged cylinders and railway axles; and from its peculiar resistance to fatigue under vibration it is used very successfully for piston rods in steam engines and rock drills. The value of nickel-steel for armor plate lies not in greater resistance to penetration, but in non-fissibility. It resists penetration admirably, it is true; but when the projectile does pierce, a clean hole is produced without shattering, and this is a feature of much importance in armor. The United States Bureau of Ordnance in a number of tests have decided on the superiority of Harveyized nickel-steel over all other competitors. An idea of the quantity which is thus consumed may be gathered from the statement that if the armor of the battleship Massachusetts carried $3\frac{1}{2}$ per cent. nickel, 75 tons of that metal would be required in its manufacture.

Nickel has a number of minor uses in the arts, of which its employment for alloys and plating may be mentioned. German silver is a well known alloy of nickel, and much of the plated ware now produced has as a body an alloy containing nickel which is so white in color that the difference between the superficial plating and the base metal is very much less apparent than when brass is used as a body. Considerable quantities of nickel salts are used for plating purposes; the most common of these is nickel-ammonium sulphate. Nickel coinage has been introduced into a number of countries with satisfactory results, as in the United States, Switzerland, Belgium, Peru, Jamaica, Brazil, Chile, Germany, Japan, Mexico, Bulgaria and the Argentine Republic.

Such are some of the uses to which this metal is put, and the list is increasing constantly. A glance at the table of statistics given previously will show a steady annual increase in the output, which is probably due chiefly to the increased demand for nickel-steel armor and ordnance. Although Canada produced in 1898 only 40 per cent. of the world's output the industry is now on a firm basis, and in the near future the operations of the new companies which are entering the field should, if all goes well, alter the ratio until the balance lies substantially to the credit of our domestic ores.



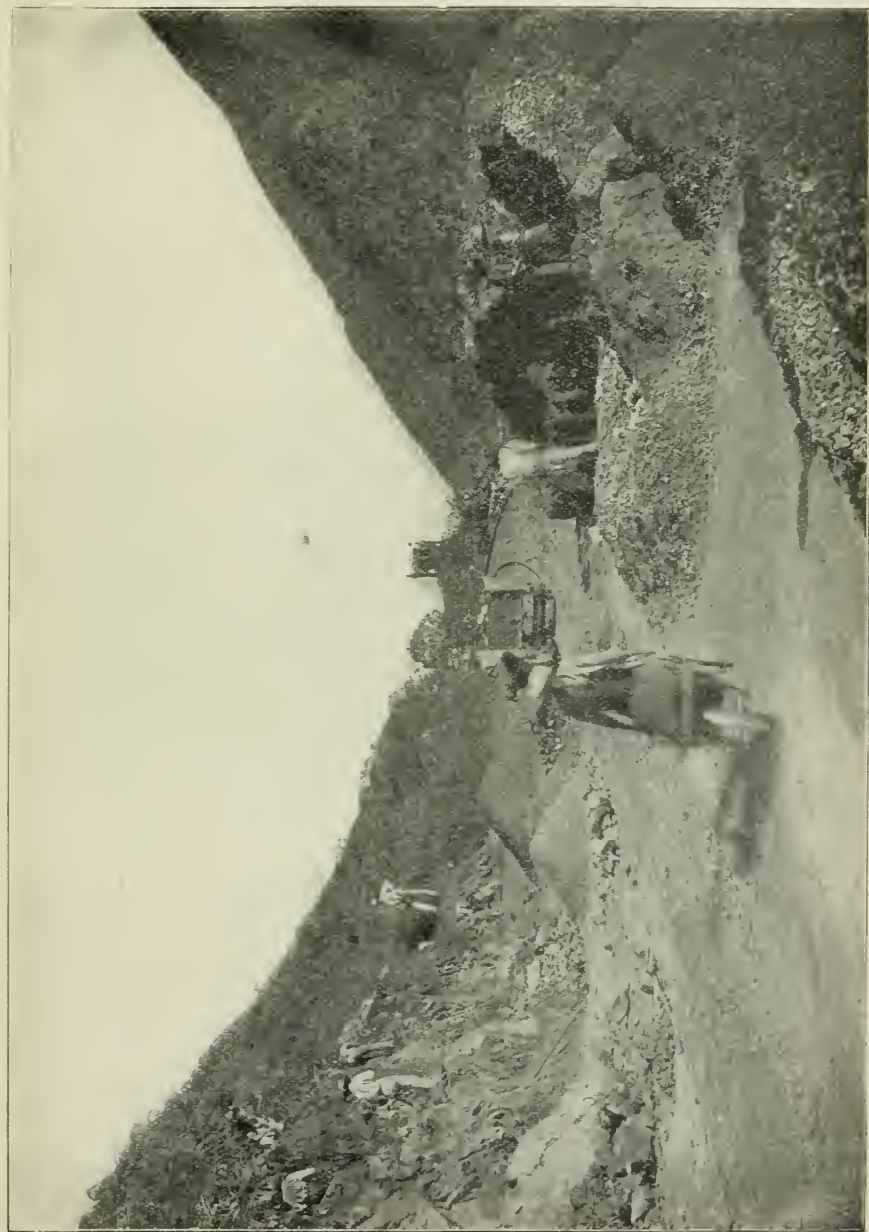
48. Rapids on Trout River. p. 136.



49. On the North Slope of Mount Horden, Algoma District, p. 137.



50. A Nickel Mine in New Caledonia, pp. 213-215.



54. Convict laborers at work in a Nickel Mine, New Caledonia, pp. 213-215.



52. Ore dump and wire tramway at Nickel Mine, New Caledonia, pp. 213-215.

THE MINES LAW OF ONTARIO¹

By Archibald Blue

In Ontario, as in all the older Provinces of Canada, the Legislature may exclusively make laws in relation to the management and sale of public lands. The Province is the owner of all unoccupied lands within its boundaries, excepting areas which have been set apart as Indian Reserves; and even on these reserves the title to gold and silver, if not to all ores and minerals, is vested in the Crown as represented by the Executive of the Province.

In the early period of our history mines, minerals and ores were not deemed worthy of being dealt with by statute law. During the first thirty years all mines of gold, silver, tin, lead, copper, iron and coal were reserved to the Crown in the patents, and in the next forty-four years all mines of gold and silver were so reserved. For three quarters of a century regulations made by Order in Council were the only mining laws. But this was largely owing to the fact that the southern portions of Ontario, which were the first to be occupied, were valuable chiefly for agricultural ore. It was only when exploration began to be carried northward into the regions of the Archæan rocks around lake Huron and lake Superior that evidence began to accumulate of the existence of valuable ores and minerals, and then the importance of making laws to regulate the sale of mining lands and the conduct of the mining industry began to force itself upon the attention of the Legislature. It was known eighty years ago that deposits of iron ore existed in the eastern part of the Province; but the valuable discoveries of minerals south of lake Huron, Georgian bay and lake Nipissing are comparatively modern. Gold, copper, corundum, arsenic, mica, apatite, gypsum and salt occur over a wide area, and some of them in great bodies. Yet, with the single exception of gold, a knowledge of the presence of these minerals in lands occupied by farmers and lumbermen did not weigh a grain in the mind of the Legislature,—no doubt owing to the fact that in some cases the Crown had parted with its interest in the lands. In the western counties, between lake Huron and lake Erie, there is an area of about 1,200 square miles underlaid with thick beds of salt, sufficient in amount to supply the world for millions of years; but nearly the whole of this tract of land, with its timber and minerals, was sold to settlers a quarter of a century before the first discovery of salt within its limits. In the eastern counties within the last four years a discovery of corundum was made which has been proved by exploration conducted under Government auspices to have an extent of four hundred square miles. In this instance, however, the lands are mostly in homestead districts, where the minerals are held as the property of the Crown, and they are disposed of under conditions which call for development and the erection and maintenance of works in the Province to manufacture the various products of the ore. But in all its main features the Mines Law of Ontario owes its origin and evolution to circumstances connected with the discoveries of minerals in the northern districts—in the territory popularly known as New Ontario.

It is not the purpose of this paper to deal with the subject historically, for this would occupy too much time. It must suffice to describe the law as it is, merely premising that, like most other laws, it is a product of experiment, and that no "Finality John" has had part in the shaping of it.

FEATURES OF THE PRESENT LAW.

The law is known by its short title as "The Mines Act," and among its first provisions are sections which abolish all royalties upon ores and minerals, and that rescind and make void all reservations of mines, ores and minerals contained in any patent, except patents issued for agricultural lands under the Public Lands Act or the Free Grants and Homesteads Acts.

Any person, citizen or foreigner, may explore for mines or minerals on any Crown lands, whether surveyed or unsurveyed, except such as may have been withdrawn from sale, location or exploration as being valuable for their pine timber or for any other

¹ A paper read at the International Mining Congress, Milwaukee. It embodies the principal features of the Act as amended in the Session of 1900.

reason, and any person attempting to explore, occupy or work any lands so withdrawn is liable to a penalty. The main object of this provision is to protect areas which have been sold as timber limits, where the pine is liable to be destroyed by the carelessness of prospectors in building camp fires. Sections which are shown to be rich in ores or minerals may also be withdrawn from sale or lease, pending a careful exploration under the direction of the Commissioner of Crown Lands, and the price of lands in a section so proven to be valuable may be fixed at any greater sum than the Act provides, or the lands may be offered for sale at public auction on such terms and conditions as may be fixed by Order in Council.

When Crown lands are situated within a mining division, and are held and worked under miners' licenses, they are known as mining claims; but when they are situated elsewhere, and are supposed to contain ores or minerals, they may be held or leased as mining lands in blocks or lots called mining locations.

In unsurveyed territory a mining location is required to be rectangular in shape, with the bearings of the outlines due north and south and east and west astronomically, with an area of not less than forty acres and sides of 20 chains, or with areas which are multiples of forty acres, as 80, 160, 320. In surveyed townships a location may be a fractional part of a lot or section, but so that its area shall be not less than forty acres; and, where road allowances have not been laid out, a reservation of five per cent. of the land is made in the patent, and the Crown or its officers may lay out roads where deemed necessary.

In unsurveyed territory mining locations are required to be surveyed by a licensed surveyor at the cost of the applicants, and to be connected with some known point in previous surveys, or with some other known point or boundary so that the tract may be laid down on the office maps of the territory. The surveyor's plan, field notes and description must be furnished to the Department of Crown Lands within four months of the time of application for the lands, and they will not be regarded as constituting a claim to the location on behalf of the party at whose instance they have been prepared unless they are filed in the department immediately upon completion of the survey. The applicant is required in addition to furnish evidence of the discovery of valuable ore or mineral in the land, as well as evidence of no adverse claim by reason of prior discovery or occupation as far as known to him, and to pay one-fourth of the purchase price or first year's rental within sixty days, and the balance within three months from the date on which his application was filed in the department. The area which any person may acquire in one calendar year of lands containing ores of the same class or kind is limited to 320 acres within a radius of fifteen miles in any one district or county, which may be composed of separate locations of not less than forty acres each; and no firm, syndicate or incorporated company may acquire more than 640 acres in one year. For every distinct kind of ore discovered within the radius of fifteen miles, the maximum area of land may be taken up in the same year; and so with any discoveries made outside of the radius of fifteen miles. But in case a prospector does not see fit to incur the expense of making a survey of a location and paying the price therefor before he has had an opportunity of proving its value, he may procure from the Commissioner of Crown Lands a miner's license, which will authorize him to stake out and work two mining locations in unsurveyed territory within a radius of fifteen miles, and hold them for a period of two years subject to an expenditure of three dollars per acre in the first year and seven dollars per acre in the second year for actual mining work. If then satisfied that the land is valuable, he may proceed to acquire it in the regular way. In the case of a prospector who is the first discoverer of valuable metals, ores or minerals upon a vein, lode or deposit not less than five miles from the nearest known occurrence of the same kind of metal, ore or mineral, he is entitled to a free grant of one location of forty acres.

HOW MINING LANDS MAY BE ACQUIRED AND HELD.

Mining lands may be acquired in fee simple upon payment of the price fixed in the Act, or may be taken up under lease tenure subject to the payment of a yearly rental. Both price and rent are regulated by distance from a railway. If a location is in surveyed territory, the price is \$3.50 per acre when within six miles of a railway, \$3 if within twelve miles, and \$2.50 if more than twelve miles from a railway; and prices are

50 cents per acre less in each case if the location is in unsurveyed territory. The rent charge is uniformly \$1 per acre for the first year, 30 cents per acre in subsequent years if the location is within six miles of a railway in surveyed lands, 25 cents if within twelve miles, and 20 cents if more than twelve miles, with a reduction of five cents per acre in each case if the location is in unsurveyed territory. At the end of ten years, if the rent has been paid and the necessary working conditions have been performed, the lessee is entitled to receive a patent for his location free from all conditions, or he may obtain a patent at any time during the demised term upon payment of rent for the full period and performance of all the covenants and conditions of the lease. In practice the lease system provides an easy term of payment, as the aggregate amount at the end of ten years is a mere trifle more than the cash price for a patent. But whether acquired in fee simple or under a lease, a location is held subject to an expenditure for actual mining operations of a sum not less than \$6 per acre during the first seven years immediately following the issue of the patent or lease, whereof \$1 per acre must be expended in the first two years and \$1 per acre in each of the following five years; and if two or more locations are contiguous, the whole of the mining work may be done upon one of them. In default of such expenditure all rights of an owner or lessee are liable to forfeit, and the land is subject to reversion to the Crown. In the case of lands valuable for iron ore, and where it is reported by an inspector or other officer that a mine may be profitably worked, the owner or lessee may be required to raise 2,000 tons a year for a period of ten years, or 20,000 tons in a shorter period of time when the location is not more than forty acres and a proportional amount if it is more than forty acres, with liability to forfeit of title if the requirement is not complied with. Failure to pay yearly rent subjects a lease to forfeiture, with reversion of the land to the Crown; but in case of a co-lessee or co-owner who defaults in rent or performance of working conditions, his interests may be vested in his co-lessees or co-owners who have paid the rent or made the expenditure for working conditions, when delinquency is proven to the satisfaction of the Commissioner.

Pine trees on lands sold as mining locations are reserved to the Crown in the patent, and any person holding a license to cut timber or sawlogs on such lands may at all times enter upon the lands and cut and remove such trees, and make all necessary roads for that purpose. The patentee, however, may cut and use trees necessary for building, fencing and fuel on the land, or for any purpose essential to the working of the mines, and may also cut and dispose of all trees required to be removed in clearing the land for cultivation. All pine trees cut on a location except for these purposes are subject to the payment of the same dues as are at the time payable by the holders of licenses to cut timber or sawlogs. If a location is held under lease, and in case it is intended to clear any portion of the land for cultivation, the lessee is required to give the holder of the timber license three months' notice, and if at the expiry of that time the timber has not been cut and removed by the holder of the license the lessee may cut and dispose of it, subject to the payment of the same dues as are at the time payable by the holder of the license. Timber other than pine upon a leased location may be cut for building, fencing and fuel, or in the course of clearing for cultivation, or for any purpose essential to the working of the mines; but none shall be cut for any other purpose except with the authority of the Commissioner, and subject to the payment of dues at the rate to be fixed by the Commissioner.

Where the surface rights have been granted for agricultural purposes, the mining rights may be acquired by a prospector who is the discoverer of ore or mineral thereon at one-half the price or rental of mining lands, subject to compensation for injury or damage to the surface rights; and in case the owners of the surface and mining rights cannot agree, the Director of the Bureau of Mines may prescribe the manner in which compensation shall be ascertained and paid or secured.

TENURE OF CLAIMS IN MINING DIVISIONS.

Whenever the Government of the Province sees fit, it may by Order in Council set apart any tract of country described in the order as a mining division, and may from time to time add to, diminish or cancel the division by an Order. Lands held for mining purposes in such a tract are known as mining claims, and the tenure is one of occupation by any person, partnership or mining company holding a miner's license. Licenses are granted for one

year on payment of a fee of \$10, and are renewable from year to year. They authorize the licensees to explore any portion of the mining division, and to mine on any claim marked or staked out by themselves on crown lands; but any person may be employed by a licensee to work his claim, or he may organize a company to work it, or may transfer it to another licensee. Discovery of a vein, lode or other deposit of ore is a prerequisite to the staking out of the claim, and it is deemed to be staked when a discovery post is planted upon an outcropping of ore or mineral in place within the boundaries of the claim, and a stake is planted at each of the four corners, numbered in order from the northeast to the northwest corner. A claim may be a square of fifteen chains, containing $22\frac{1}{2}$ acres, or of any other extent greater or less as may be fixed by regulation, but so as not to exceed a square of 20 chains containing forty acres, and the ground included in each claim is deemed to be bounded under the surface by lines vertical to the horizon. A licensee who has staked out a claim is required within thirty days to register it with the Inspector for the division by filing under oath an outline sketch of the plan, showing the discovery post and corner posts and their distances from each other, together with a notice in writing setting forth the name of a licensee, the locality of the claim as indicated by some general description, the time when it was marked out, the length of the boundary lines if for any cause they are not regular, the situation of the discovery post and the date of the record; and the Inspector is required forthwith to enter the particulars of the notice in his book, and file the notice and sketch or plan of the claim with the records of his office. If the licensee fails to comply with the requirements for registration, or if, having complied with them, he or any person on his behalf removes any post for the purpose of changing the boundaries after the plan and notice have been filed, the claim shall be deemed to be forfeited and all the rights of the licensee in it shall cease. A claim may also be forfeited if the miner's license has run out and has not been renewed, or if the annual fee has not been prepaid in the case of a licensee who is the holder of more than one claim, or if a sum of \$150 has not been expended upon it in actual mining work. No more than one claim may be staked out upon the same vein, lode or deposit of ore by an individual licensee, unless it is distant at least sixty chains from the nearest known mine, claim or discovery on the same vein or lode; but no licensee may stake out and record in the same mining division more than four claims in one calendar year within a radius of fifteen miles, and for each additional claim after the first a fee of \$10 is required. A licensee who is the holder of five claims or less within a radius of one mile may carry on all mining operations demanded by the Act upon one of them, or different persons holding claims within a radius of one mile may combine to expend all operations on one claim for every five claims or less.

When the working conditions have been complied with for a period of four years on a claim of 20 chains square, or for three years on a claim of 15 chains square or less, or when an equivalent of such working conditions has been complied with in a less period of time, the licensee may apply for and obtain a certificate of full performance of working conditions for the claim free from any other working conditions, renewal fee or miner's license. He may also, if he desires to hold the claim under a patent or lease, proceed to get a survey made of it as a mining location, and pay in the purchase money or first year's rent at the rates fixed by the Act for mining locations. This provision, however, is not for the sake of securing a better title, but to satisfy a desire for better description by metes and bounds, a holding under the great seal, and the right to record in the office of the Register of Titles.

THE BUREAU OF MINES.

Other provisions of the Mines Act relate to mining regulation for the health and safety of men employed in mines and mining work, and for the punishment of offences against the Act. There are also provisions for administration under the office of the Bureau of Mines, which was organized to aid in promoting the mining interests of the Province. The inspection of mines, the conduct of exploratory work under direction of competent geologists, the operation of diamond drills and the encouragement of iron mining by the payment of a bonus to miners for ores smelted in the Province, are all within the sphere of the Bureau's operations.

EXPLORATION OF UNKNOWN ONTARIO.

During the present season ten exploration parties have been organized to make a careful examination and report on the northern regions of Province. This territory extends from the Quebec boundary on the east to the Manitoba boundary on the west, a length of about 700 miles, and its area is about 90,000 square miles, or about 40 per cent. of the whole Province. It is one and a half times larger than the whole State of Wisconsin, and nearly twice as large as the Orange Free State ; but excepting along the lines of its canoeable waters it is as little known as the Congo Free State in the heart of Africa. Almost certainly it is a region in which there are great forests of spruce and other kinds of trees, valuable for pulpwood ; there are wide tracts of clay loam deposited in ancient lake bottoms, as well as large areas of till, both of which are calculated to form the best of farm land ; and there are many thousands of square miles of the Archæan formations in which the trained prospector may hope to find rich stores of ores and minerals.

PROVISION FOR REFINING NICKEL ORE.

I have kept for the close of my paper reference to a new provision of our Mines Act, which, however, has not yet been brought into operation. Its purpose is to secure to Ontario a larger share of an industry which in recent years has been built up out of raw materials which the Province possesses in large abundance, namely, the refining of nickel and the production of nickel steel. Two works with ample capital are in course of construction for the production of steel, the refining of nickel and the manufacture of nickel steel, and one if not both of them includes in its scheme a plant for the making of nickel steel rails for railways, at a cost estimated to exceed but a little the cost of Bessemer rails. For this industry Ontario is well favored by its supplies of the raw materials, and, if deemed necessary for the object in view, effect will be given to the provision of the law when the works are equipped and practically established. Stated in its briefest terms, the provision requires that every person carrying on the business of mining nickel ore in the Province shall pay to the Treasurer of the Province a license fee computed at or below a fixed maximum rate upon the gross quantity of ore raised or won by him during the preceding year, with a right to remission if the ore has been treated in the country so as to yield fine metal, or other form or product of the ore suitable for direct use in the arts without further treatment. But, until brought into force by proclamation of the Lieutenant-Governor in Council, this provision shall not take effect.

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REPORT

OF THE

COMMISSIONERS

FOR THE

QUEEN VICTORIA NIAGARA FALLS PARK

1899

PRINTED BY ORDER OF
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TORONTO;
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1900.

FOURTEENTH ANNUAL REPORT

OF THE

COMMISSIONERS

FOR THE

QUEEN VICTORIA NIAGARA FALLS PARK

*To the Honourable SIR OLIVER MOWAT, K.C.M.G.,
Lieutenant-Governor of the Province of Ontario.*

MAY IT PLEASE YOUR HONOR:—

The Commissioners for the Queen Victoria Niagara Falls Park beg to submit their Fourteenth Annual Report, accompanied with the usual statement of receipts and expenditures, being for the year ending 31st December, 1899.

In their last annual report the Commissioners made an extended reference to the delays which had occurred in commencing the works for the developing of the water power of the Falls for manufacturing purposes, and set forth the temporary arrangement which had been entered into for the supply of electricity to meet the immediate requirements of local users from the surplus hydraulic power generated in the power houses of the Niagara Falls Park and River Railway.

As public sentiment distinctly appeared to favor the cancellation of the monopoly clause in the Canadian Niagara Power Company's agreement and the granting of equal rights to other companies desirous of using the water power of the Falls for commercial purposes, the Legislature at its last session passed an Act (62 Vic 2, chap. II, par. 35) conferring upon the Commissioners authority to negotiate with the Canadian Niagara Power Company for the surrender and abandonment of the sole or exclusive right to use the waters of the Niagara River within the limits of the Park, granted by the agreement of April, 1892, upon such terms and conditions as might appear to be necessary in the public interest.

After protracted negotiations the Commissioners, with the approval of the Government, on July 15th last, entered into a new agreement by which the exclusive right in the waters of the Niagara River within the Park, heretofore enjoyed by the company, was abandoned, and the time for commencing and completing the initial development of 25,000 hydraulic and 10,000 electrical horse power was extended. Approval was also given the specifications and revised plans of works which the company require in the carrying out of their enterprise in the Park.

In order to secure the abandonment of the monopoly clause on the part of the company, it was found necessary to make some concession in the rental, which would facilitate the financing of the enterprise, until a market for a reasonable amount of the product could be found and the business of the company placed upon a secure basis. The Commissioners are convinced that the principle adopted in the new agreement of paying a fixed rental for the first 10,000 horse power generated and disposed of, and thereafter a charge for every additional horse power sold, will produce a much larger revenue to the Commissioners in the course of a few years, and will assist greatly in inducing other capitalists to engage in developing other and competitive power projects, to the great and permanent gain of the community and the best interests of the Park and of the Province.

The terms of this agreement will be found in the appendix to this report.

Since the execution of the agreement, the Company have been engaged in making core test holes at several points along the line of its proposed works, in order to determine the nature of the rock in which their excavations and tunnels will be constructed.

By the Act 62 Vic. (2) chap. 11, par. 35, above referred to, authority was conferred upon the Commissioners, subject to the approval of the Lieutenant-Governor in Council, to enter into agreements with any other persons or companies for using the waters of the Niagara or Welland Rivers to generate electric or other power at certain points, within or without the park, upon such terms and conditions as might be agreed upon. Under the provisions of this authority the Commissioners have concluded an agreement with the Ontario Power Company, a company holding a charter under the Dominion Government, to utilize the waters of the Welland River for power purposes.

Under this agreement, the text of which will be found in the appendix to this report, the Ontario Power Company propose to develop power under two heads. In the first instance the waters of the Welland River will be conducted in an open canal or head race to a power house located in the park immediately behind the present gravel pit; and after passing through the water wheels will be discharged directly into the Niagara River, at a point a short distance up stream from the proposed intake of the Canadian Niagara Power Company. At this power house a head of over forty feet may be utilized. In the event of the power generated at the first power house being insufficient to meet the demands of customers, the Company have the right to conduct the spent water from the tail race of the first development by means of an open channel within the park to within a short distance of the Table Rock House; thence by means of a covered forebay or underground channel to a second power house situate on the talus in the gorge below the Falls, where the full available hydraulic head of the Horse-shoe Falls may be obtained.

The rental to be paid by this Company for the rights granted is identical with that fixed by the new agreement with the Canadian Niagara Power Com-

pany, viz., a fixed rental of \$15,000 a year for the first 10,000 electrical horse power generated and disposed of, and an additional charge for every horse power disposed of beyond the first ten thousand. The sum of \$30,000, being the amount of two years' rental, has been paid to the Commissioners. The time limit and the other requirements of the agreement are practically identical with those stipulated for in the new agreement with the Canadian Niagara Power Company.

By an accidental contact of the wires connecting the large new generators placed in the power house of the Niagara Falls Park and River Railway Company to supply electricity to local users for manufacturing purposes, this substantial structure, together with all the electrical apparatus and appointments contained therein, were destroyed by fire on the night of September 4th last. By the destruction of this power station all the industries which had been using electrical power were at once crippled, and some of them which had no other means of obtaining power were compelled to close up.

On representations being made to the Commissioners and the Government that many interests were suffering for want of this power, and that some time must necessarily elapse before the generating station of the railway company could be restored, and there being at the present time no other available source from which a supply could be obtained, authority was granted by the Commissioners to the Canadian Niagara Power Company to bring over from the American side sufficient electricity to supply the Niagara Falls Park and River Railway and the industries which were under contract with that Company for the delivery of power at the time of the fire. But this authority was granted on the distinct understanding that it was for temporary purposes only, and was in no sense to delay the carrying out of the works of the Company under their agreement, and that the privileges may be abrogated at any time by the Commissioners or by the Government.

The Fort Erie Ferry Railway Company owning and operating the short line of railway, extending from Fort Erie southward along the lake shore to a pleasure resort, having obtained legislative authority to extend their line in a northerly direction to or near the Village of Chippawa, made application for a right of way upon the lands of the Commissioners, known as the Chain Reserve, which lies along the west bank of the Niagara River, in front of the Villages of Fort Erie and Bridgeburg and the Townships of Willoughby and Bertie, and upon which a public road is constructed. As much of this reserve has been narrowed in by the erosion of the river, and as in front of certain farms no reserve was made when the original patents were granted, it became necessary to acquire additional lands in order to provide sufficient room for both the highway and railway.

By the terms of the agreement made with this Company they are to secure all the additional lands required, and vest the same in the Commissioners, form a suitable highway of prescribed width, provide all the necessary drainage, bridges, etc., on the west side of the acquired lands, after which a single or double track

railway, to be propelled by electricity, may be constructed along the water's edge, from the present northerly terminus of the Company's line at the International Ferry in Fort Erie to Slater's Point, the present southerly terminus of the Niagara Falls Park and River Railway.

The rental which the Company is to pay to the Commissioners for the rights granted is at the rate of \$1,000 a year for the first seven years, \$1,200 a year for the following three years, \$1,500 a year for the next five years, and \$2,000 a year for the balance of the twenty-one years' period.

In their last report the Commissioners referred at length to the continued defacement of the historic grounds around old Fort Erie, and to the desirability of having the ordnance lands at this place transferred to them, so that the properties may be preserved and developed as a part of the Niagara Falls Park system. In addition a full report of the Superintendent of the Park on the method of treatment proposed for improving the property was given.

The Commissioners regret to learn that an effort is being made to lease this historic ground for a term of years to a number of Buffalo gentlemen for a golf ground, and that it is proposed to erect thereon a club house and other buildings. There are not many places in Ontario more closely associated with its early struggles than Fort Erie; and we cannot refrain from expressing our hope that a more honorable and worthy disposition shall yet be made of this hallowed ground, the scene of many sanguinary battles in 1812-14 and where many of our honored dead still lie buried.

On the 21st of July the International Bridge at Queenston Heights, which has been erected on the site of the former carriage suspension bridge, built in 1850 and destroyed by a storm a few years later, was formally opened for traffic. It is a very substantial structure, with a central track for the interchange of traffic between the Niagara Falls Park and River Railway and the Gorge Electric Railway, and two carriage ways for vehicular traffic.

In last year's report a number of important permanent improvements were enumerated, which the Commissioners considered to be urgently required in the park, and a small additional issue of park debentures was recommended in order to secure their execution. The recommendation was not acted upon; but owing to the increased revenue which we have been able to secure, through the granting of the rights and privileges above referred to, provision for some of these works can now be made out of income. There are, however, several very important improvements which the Commissioners are desirous of carrying into effect this year that will require an expenditure beyond what can possibly be obtained from revenue account; and they, therefore, again recommend that authority be given to issue park debentures to the amount of twenty-five thousand (\$25,000) dollars, in order that early provision may be made for these important improvements. The debentures to bear interest at the rate of three and one-quarter per cent., and to mature at the same date as the previous issues.

A detailed description of the works undertaken and accomplished during the year will be found in the report of the superintendent of the park, which is appended hereto.

The following statement will show the receipts and expenditure for the year :

RECEIPTS.

Rental from the Canadian Niagara Power Company	\$20,000 00
Rental from the Niagara Falls Park & R. Ry. Co.	10,000 00
Rental from Zybach & Co	8,200 00
Rental from the Maid of the Mist Steamboat Co	300 00
From tolls on islands and at Brock's Monument	1,808 20
From sales of materials, etc.	480 72
" Imperial Bank, interest on balances ..	38 19
" " " overdraft on December 31st, 1899	6,790 75
	<hr/> \$47,617 86

EXPENDITURE.

Paid Imperial Bank overdraft on January 1st, 1899.....	\$ 729 71
Capital account—	
Paid for permanent improvements, including cost of materials.....	\$ 6,040 53
" wages of mechanics and laborers	2,010 00
" miscellaneous, including legal expenses	180 00
	<hr/> 8,230 53
Maintenance account—	
Paid salaries and wages, including wages of laborers, teams, etc.	11,948 40
" cost of materials	1,760 38
" office expenses, etc.	213 23
" Commissioners' expenses	178 24
" miscellaneous "	243 00
" interest on bank overdrafts.....	139 18
	<hr/> \$14,482 43
" coupon interest on bonds and bank charges	24,175 19
	<hr/> \$47,617 86

All of which is respectfully submitted,

J. W. LANGMUIR,
Chairman.

GEORGE W. WILKES.
B. E. CHARLTON.
JAS. BAMPFIELD.
A. M. CAMPBELL.

Niagara Falls, April 13th, 1900.

APPENDIX A.

REPORT OF THE PARK SUPERINTENDENT.

To the Commissioners for the Queen Victoria Niagara Falls Park:

GENTLEMEN,—I beg to submit the following report of the works done in connection with the Niagara Falls Park, during the year ending 31st December, 1899.

GENERAL MAINTENANCE

Notwithstanding the unusual severity of the winter, the spring of 1899 opened favorably, and the customary cleaning up and other works included under this heading were early begun. The Board having enjoined the strictest economy in expenditure, these works were necessarily confined to the improved portions of the park at Niagara Falls and Queenston Heights, and but little could be done to the many outlying points where improvements have been commenced.

In last year's report the works necessary for the reclaiming and improving of the unsettled portions of the park system were referred to as being steadily carried on from year to year, and it is greatly to be regretted that circumstances should prevent this principle from being adhered to, even for one year, as there is much territory remaining practically uncared for, which it is most desirable to have improved at the earliest possible moment.

THE DRIVEWAY.

As it had been found impossible to maintain a good surface to the principal driveway through the park by means of the gravel found on the premises, it was decided to re-surface the whole of the road extending from the Mowat Gate to Table Rock, including the several turnouts, with macadam. The foundation for this roadway having been substantially constructed in the first instance, comparatively little work beyond rolling was required to prepare a proper bed for the broken stone. This was procured from the St. Davids and Hagersville quarries: and after the road bed had been thoroughly consolidated by the steam roller, the stone dressing was applied in successive layers, compacted and brought to a hard, smooth and well formed surface, the whole having been completed before the opening up of the summer travel.

In order to secure a better grade for the upper end of the road, it was necessary to raise the sidewalk and railing between the Restaurant and Table Rock, and to define the easterly margin of the driveway with curb stone. As this portion of the driveway is continuously drenched with spray, additional cross drainage was put in so as to afford a ready means for the removal of surface water. The improvement to this portion of the park is very marked, and an opportunity will be given to test the permanence of the macadam under the severe conditions obtaining in this vicinity.

The pathways on either side of the main driveway from the Mawat Gate to the Pic-nic grounds were raised to correspond to the new road levels, by applying a heavy coating of cinders and surfacing with selected and screened gravel.

A few low and wet spots in the driveway south of Table Rock were filled up with macadam; but as the traffic on this part of the road is comparatively light, repairs where needed were made in the usual way with ordinary pit gravel.

TREES, SHRUBS AND PLANTS.

A very good collection of flowering shrubs was secured from the Font Hill Nurseries and put out in good season, and a few choice conifers for specimen trees and for screens, where desired, were added to our stock, but the necessity for economy in expenditure prevented as large an addition as was desirable.

The exceptionally severe weather experienced last winter did some slight damage to the more tender varieties of trees and shrubs which had been previously put out. The abnormal conditions consisted not only in low temperature but in absence of snow, sudden changes from low to high temperature, sleet storms, etc.; so that an excellent opportunity has been afforded of testing the hardihood of plants not indigenous, but which we are most desirous of having in the park; and the fact that out of our collection of sixty-two of the finest varieties of lilacs, imported from France and set out last year, only three have perished, and the safe wintering of Azalias of the Mollis and Ghent varieties, Rhododendrons, Chinese magnolias, Paulonia Imperialis, Forsythias and the tender varieties of the Duetzia, without any kind of winter protection, afford a striking proof of the suitability of the park for the cultivation of delicate and half hardy stock which cannot be safely grown in other parts of Ontario.

CONSERVATORY.

A small addition was made to the collection of flowering plants in the Conservatory, which continues to attract much attention from both citizens and visitors. A large stock of choice bedding and flowering plants for outside service is propagated annually, in order to brighten the pic-nic grounds and other points in the park, where the use of flowers is permissible. A good beginning has also been made in setting out a large variety of bulbs for early spring blooming.

SHORE PROTECTION.

The portion of Riverside Ramble extending from the electric railway bridge to the summer house under Clark Hill, which had not been completed in 1898, was properly filled up with stone and surfaced with gravel. The whole length of this shore protection work is now railed and finished, and forms a shady and much appreciated promenade. The renewing of the cribwork which also forms the walk along the south side of the Dufferin Islands, should have been attended to this year, but of necessity had to be left over until next year.

BRIDGES AND BUILDINGS.

Only the most necessary repairs were made to the park bridges during the year. The foot suspension bridge leading to the Dufferin Islands is past repair, and requires to be wholly rebuilt. The two driveway suspension bridges require extensive renewals and repairs both to the chords and the needle beams before the seasons opens, in order so make them safe for traffic. At the best these suspension structures are unsatisfactory.

The stability of the anchorage on which the safety of the bridge depends is not definitely known, and on busy days the stoppage of traffic caused by the single way is annoying to visitors, while the bridge structures are costly to maintain. They should be replaced as soon as possible by rigid double way bridges of steel, suitably designed and of a high degree of permanence.

The gate man's dwelling at the Dufferin Gate was put in a good state of repair during the season. The valley in the roof was taken out and a high pitch roof substituted, which admitted of two more bed rooms being provided up stairs and other needed accommodations arranged for.

LAWN TENNIS COURTS.

An urgent request was made in the spring, by a number of the leading citizens, for a portion of the park to be set apart for a lawn tennis. A two court ground was selected, graded and sodded which proved to be a desirable addition to the facilities for enjoyment already afforded by the park. Suitable water supply is, however, needed for sprinkling the courts in dry weather.

The grading and surfacing of the front of the park, which was begun in 1898, could not for economical reasons be carried on during the year.

ICE BRIDGE.

The unusual severity of the winter was clearly demonstrated by the enormous flow of ice in the river. This jammed at the narrows immediately below the upper steel arch bridge, and formed an ice bridge of more than usual grandeur. The constant stream of ice appeared to have difficulty in finding a passage under the ice bridge in the narrowest part of the gorge, and in consequence the water level south of this point was at times raised to an unusual height. On the 24th of January for instance it was thirty feet above ordinary summer level, while in the spring when the ice bridge gave way, the mounds of ice piled up to such an extent as to rub against the spandrels of the steel arch bridge in passing down stream. As a result of this great accumulation and movement of ice, the wharves of the Maid of the Mist Steamboat Co. on both sides of the river were destroyed; and at many points along the shore the heavy masses of rock forming the talus were shoved out of place, and trees and vines growing above the ordinary water mark were torn up and carried away.

WHIRPOOL POINT AND NIAGARA GLEN.

The filling up of a portion of the grounds at Whirpool Point with soil, referred to in last year's report, afforded an opportunity of setting out some good foliage trees and shrubs on this very bare but much frequented part of the park system. Good shade and a rustic shelter are badly needed at this point.

At Niagara Glen an improved pathway leading to the spring was made; and the immense overhanging boulder which partially blocked the way was blasted off. The first link in the pathway designed to skirt the water's edge, from the spring southwards to Fisherman's Eddy, was also constructed. This path will command a close view of the majestic sweep of the rapids, and the short portion already made has been much appreciated by visitors.

QUEENSTON HEIGHTS.

During the year no new works of importance were attempted at Queenston Heights. The dense growth of cedar on the slope of the Heights and in the grove west of the monument was thinned out and all dead wood removed. The

delicious cool water from Brock's Spring was carried to a point near the keeper's lodge, and facilities for drawing and draining it off provided. The path leading to Brock's Cenotaph was gravelled and the ground kept in nice order.

The construction of approaches to the new suspension bridge and the transport of heavy materials for the structure involved much cutting up of the ground between the highway and the bridge. Until this damage is repaired and the new earthwork is covered with foliage or grass the scenic effects must be objectionable. A great deal of cleaning up and thinning out is needed in this portion of the park grounds to make it attractive.

NEW SUSPENSION BRIDGE.

The beautiful suspension bridge erected by the Queenston Heights Bridge Co. on the site of the former structure, was formally opened for traffic on July 21st. The dinner given to celebrate the event was served upon the Heights, and a distinguished company from both sides of the Niagara assembled to honor the occasion.

The ordnance lands west of Brock's Spring and extending along the Heights to the second concession, which are now under the control of the Commissioners, require to be fenced off and the property made accessible to visitors, but this like many other very necessary works has had to be deferred.

The whole respectfully submitted,

JAMES WILSON,
Superintendent.

NIAGARA FALLS, 31st December, 1899.

APPENDIX B.

This agreement made this fifteenth day of July, 1899, between the Commissioners for the Queen Victoria Niagara Falls Park, acting herein on their own behalf and with the approval of the Government of the Province of Ontario, and hereinafter called the Commissioners of the first part, and the Canadian Niagara Power Company, of the second part.

Whereas by the Act of the Legislature of Ontario passed at a session held in the sixty-second year of Her Majesty's reign, chaptered 11, and by section 35, it is enacted as follows :

"The Commissioners of the Queen Victoria Niagara Falls Park, with the approval of the Lieutenant-Governor in Council, and the Canadian Niagara Power Company may enter into an agreement for the surrender and abandonment of the sole or exclusive right to use the waters of the Niagara River within the limits of the said Park granted by the agreement bearing date the seventh day of April, 1892, between the Commissioners of the Queen Victoria Niagara Falls Park acting herein on their own behalf and with the approval of the Government of the Province of Ontario and therein called the Commissioners of the first part, and Albert D. Shaw of Watertown, in the State of New York, Francis Lynde Stetson and William B. Rankine of the City of New York, in the State of New York, therein called the company of the second part, and set out in chapter 8 of the Statutes of Ontario, 1892, upon such terms and conditions as to abatement of rent, the extension of time for the completion of the contract under the said agreement or any variation of the said contract and for other purposes in

connection therewith as may to such Commissioners and to the Lieutenant-Governor in Council appear to be necessary or in the public interest, and any such agreement so entered into shall be binding and effectual according to its terms."

Now therefore this agreement witnesseth and it is hereby agreed by the parties to these presents as follows, that is to say:

1. The location of buildings and power houses as defined by paragraph 1 of the agreement of the 7th April, 1892, above recited, is changed to the location shewn on the plan annexed marked A, and the points of intake and discharge indicated and laid down on such plan are hereby declared to be the locations settled according to the provisions of the agreement of the 7th April, 1892, as if the same had been described and selected in terms of said agreement with the approval of the Commissioners.

(a) And these presents testify approval by the Commissioners of the location of the building and works with their accompanying requirements to be done and executed by the Company in respect of the powers to be exercised within the Park which, by paragraph 14 of the agreement of the 7th April, 1892, are to be subject to the approval of the Commissioners.

(b) The expression "general plans and specifications or general specifications" mean, and are to be taken to mean, the plans and specifications submitted by the Company to the Commissioners for approval, of which one complete set will remain in the possession of the Commissioners and the other in the possession of the Company; and both duly identified at the time of the execution of these presents, under the corporate seals of the respective parties hereto, as also under the hands of the head officers thereof.

(c) Such general plans and general specifications shall form part of this agreement and are as to their approval by the Commissioners to be controlled by the designs and changes therefrom appearing upon the annexed plan marked "A" and the terms in these presents set forth, which plan and terms shall be taken as varying the said general plans and specifications and the agreement of the 7th April, 1892.

(d) As to the provisions of paragraph 14, sub-section A of the agreement of the 7th April, 1892. "In respect of the excavation of the channels to lead the waters of the Niagara from the point or points of intake to the location of the power houses, including the precautions necessary in relation to making openings under the railway for the admission of the waters of the river, including the wheel pits, tunnels and portals to discharge the same, and the point of such discharge below the Falls."

The Commissioners hereby approve of the location of the said works described in the above sub-section as indicated upon the plan hereto attached, to be constructed in detail as in the general plans and specifications of works to be done, as by the plan hereto attached are changed or varied.

Provided, that the Company do obtain an instrument under the corporate seal of the Niagara Falls Park and River Railway Company granting to the Company, with the approval of the Commissioners signified as parties thereto, the right to make openings at the points of intake under the railway in accordance with the plan marked "A" hereunto attached and having relation to the general plans and specifications above mentioned, and also that the Company do obtain the approval of the proper authority for the construction of bridges to carry the railway over such openings, and that in respect of such works as affect the railway or any damages sustainable thereto, the agreement shall provide that the Railway Company shall have no recourse against the Commissioners.

(e) As to the provisions of subsection (b) of paragraph 14: the site of the building and power house as laid down on the plan annexed, to be in accordance with the general design and form as in general plans and general specifications.

(f) As to the provisions of subsection (c) of paragraph 14: the construction of the conduits to convey electricity or pneumatic power without the Park in furtherance of paragraph 7 of the agreement of the 7th April, 1892, shall be conveyed only by means of conduits beneath the Park at such depth as the Commissioners may from time to time determine.

(g) The Company shall remove all surface soil from the site or sites of the work, and deposit the same as when and where directed by the Commissioners.

Such surface soil shall be available for any purposes within the Park for which the Commissioners may have use as they may be necessary or convenient, and they may use and apply the same to such uses, without any compensation being made to the company therefor, nor shall the company be thereby relieved from the covering up and filling with good soil as a top dressing of any of the refuse or excavated materials which the Company are by these presents required to distribute and cover up with good soil.

(h) The removal and distribution of excavated or refuse material from the excavations of the channels from the point or points of intake for the foundations, construction of the building and power house, wheel pits, sluiceway, tunnel and portal to discharge the waters at foot of the cliff below the Falls, conduits within the Park to convey the electricity or pneumatic power to places beyond the Park, and from any other works which are agreed to be done by the Company, by these presents, or by the agreement of the 7th April, 1892, shall be distributed and deposited wholly or in part as the Commissioners may from time to time require and point out at the localities hereinafter specified.

(1) Either by way of extension of the foreshore of the Niagara River in an easterly direction from the edge of the Horse Shoe Fall southward along the river bank, in accordance with the alignment shown by red lines on the annexed plan marked "new shore line to which excavated material shall be deposited." Such material along such line shall be protected at the base or where in contact with the water by massive stone riprap.

(2) Or in filling up the natural stream of the Niagara River flowing between Cedar Island and the mainland or any part thereof.

(3) Or in raising the level of the west bank or shore of Cedar Island.

(i) And all the area or space over which such material shall be distributed shall be covered over with good soil, and put in condition for sowing grass seeds or planting.

(j) If there be any material which the Commissioners deem to be in excess of their requirements of distribution or the requirements of the Company, it shall be taken away by the Company and disposed outside the park limits.

(k) The excavated or refuse material taken out at the portal at foot of the cliff below the Falls and not required by the company, shall be distributed at some point or points below the cliff as the Commissioners may from time to time point out, but shall not require to be covered with good soil.

(l) Tramways for construction purposes shall be placed or changed only on the approval of the Commissioners; steam power for drilling, excavating or hauling materials, or driving machinery shall not be used on the surface of the park, but below the cliff only, but steam power may be used on the surface of the park for furnishing compressed air for drilling and other purposes connected with the works.

(m) So soon as the Commissioners deem that in the execution of any of the works to be by the Company done or performed, or preparations for the same, the main travel driveway through the park, or other Park Road, or pathway now in use, is or about to be incommoded or interfered with, the company shall forthwith make such deviations of the said driveway or other ways as the Commissioners shall direct and require, although such deviation of the driveway may require a bridge to be built from Cedar Island to the mainland. The safety of

any bridge to be built, and provisions for the public safety at such deviations shall not be inferior to those of other bridges or ways presently in use within the park.

(n) Whereas by paragraph 6 of these presents the period of time in paragraph 10 of the agreement of the 7th April, 1892, relating to the completion of water connections for the development of 25,000 horse power and having actually for use, supply and transmission 10,000 developed horse power is extended to the first day of July, 1903, and subject in the case of non-completion on the said day last mentioned to the forfeiture of all licenses and powers as by said paragraph 10 is provided; such provisions for forfeiture in said paragraph 10 being wholly irrespective of the provisions for forfeiture provided by paragraph 4 of the agreement of the 7th April, 1892, in case matters might arise giving occasion for the exercise of forfeiture; and whereas time is made of the essence of the contract for the observance by the company of the several provisions contained in both said paragraphs 10 and 4 and each of them, it is hereby further agreed that in respect of all other matters by the company agreed to be done by the period hereinafter limited such as distribution and removal of excavated or refuse material and finish and ornamentation of surfaces, including the perfected condition of the roads, bridges, and other works, not necessarily affecting the development and transmission of the electrical or pneumatic power above described as the Commissioners may require to be done, completed, and made perfect in accordance with the general specifications as varied by the plan hereto annexed, shall be done and completed by the first day of July, 1904, in every respect in perfect condition.

(o) If the company should not complete the works lastly mentioned, namely, distribution and removal of excavated or refuse material and finish and ornamentation of surfaces, including the perfected condition of the roads and bridges and other works lastly mentioned, and deliver them over to the Commissioners in good and complete order and condition to their satisfaction, on or before the 1st day of July, 1904, the company shall pay to the Government of Ontario, by way of ascertained damages, the several sums hereinafter mentioned, that is to say, the sum of five hundred dollars per week, for each week that the same, or any parts of said works, remain incomplete after such time, whether the contract has been forfeited by the several conditions in these presents or in the agreement of the 7th of April, 1892, or abandoned by the company or not.

(p) In the event of the works as hereinbefore specially specified in the preceding subsection lettered (o) not being completed within twelve months after the 1st day of July, 1904, the company shall pay the sum of ten thousand dollars (\$10,000), in addition to the sum of five hundred dollars for each and every week as aforesaid. Such sums of five hundred dollars per week and the sum of ten thousand dollars shall be considered as ascertained and liquidated damages.

2. The said agreement of the 7th April, 1892, in respect of the amount of rentals and period for which the same is payable is hereby amended by providing that from and after the first day of May, 1899, the rent payable under the said agreement in lieu of that specified in paragraph 4 thereof shall be up to the first day of May, 1949, the sum of fifteen thousand dollars per annum, payable half-yearly on the same days and times as specified in said paragraph 4 of said agreement and in addition thereto payment at the rate of the sum of one dollar per annum for each electrical horse power generated and used and sold or disposed of over ten thousand electrical horse power up to twenty thousand electrical horse power and the further payment of the sum of seventy-five cents for each electrical horse power generated and used and sold or disposed of over twenty thousand electrical horse power up to thirty thousand electrical horse power and the further payment of the sum of fifty cents for each electrical horse power generated and used and sold or disposed of over thirty thousand electrical horse power; that is to say, by way of example, that on generation and use and sale

or disposal of thirty thousand electrical horse power the gross rental shall be \$32,500 per annum payable half-yearly, and so on in case of further development as above provided, and that such rates shall apply to power supplied or used either in Canada or the United States. Such additional rentals as shall be payable for and from such generation and sale or other disposition as aforesaid to the Commissioners shall be payable half-yearly at the rate above specified on the first days of November and May in each year for all power sold in the said several half-yearly periods from the day of sale; and within ten days after said first days of November and May in each year on which such additional rentals shall be payable respectively the treasurer, or if no treasurer the head office of the company shall deliver to the Commissioners a verified statement of the electrical horse power generated and used and sold or disposed of during the preceding half year and the books of the company shall be open to inspection and examination by the Commissioners or their agent for the purpose of verifying or testing the correctness of such statement; and if any question or dispute arises in respect of such return or if any statement delivered at any time by the company to the Commissioners of the quantity or amount of the electrical horse power generated and used and sold or disposed of or of the amount payable for such additional rentals the High Court of Justice of Ontario shall have jurisdiction to hear and determine the same and to enforce the giving of the information required.

3. All the provisions of the agreement of the 7th April, 1892, applicable to the rent thereby reserved, including the proviso in paragraph 4, relating to the re-entry and forfeiture in case of rent being in arrear, shall be applicable to the rentals payable under these presents.

4. After the first day of May, 1949, the same rentals as are hereby reserved shall continue to be paid by the said company unless the Lieutenant-Governor-in-Council shall desire a readjustment of the said rent, in which case the rentals for a further period of twenty years shall be readjusted by agreement and in the absence or failure of agreement by the parties hereto then the rentals for such further term shall be ascertained by three arbitrators, or a majority of them, one of whom shall be named and appointed by the Commissioners, another by the company and the third by the Chief Justice or senior presiding Judge of the Provincial Court of Ultimate Appellate Jurisdiction for Ontario, and the award of such arbitrators shall be subject to the same provision of law as if the said arbitrators had been appointed by the said parties upon a voluntary reference under the Revised Statute of Ontario respecting arbitrators and references, and the Lieutenant-Governor-in-Council may in the like manner for two further periods of twenty years each, require a readjustment of said rentals, in which case the same shall be determined as aforesaid, and at the expiration of such three periods of twenty years each the term so limited by these presents shall determine and end in accordance with all provisions contained in paragraph 5 of the agreement of the 7th April, 1892. Either party to such arbitration may appeal from any such award upon any question of law or fact to the said Provincial Court of Ultimate Appellate Jurisdiction for Ontario, and the said Court shall have the same jurisdiction therein as a judge has on an appeal from a report or certificate under section 4 of the aforesaid Revised Statute respecting arbitrators and references. And it is hereby further agreed that at any time not less than three years before the period at which such third renewal of twenty years shall terminate the Lieutenant-Governor-in-Council, and notice thereof to the company given, may require the company to continue its operations for a further period of twenty years, to commence from the termination of such third renewal, at the same rentals as shall have been paid during the said third renewal period of twenty years, or at a readjustment of said last mentioned rentals for such further period of twenty years by agreement, and in the absence or failure of agreement by the parties hereto, then the rentals for such further term of twenty

years shall be ascertained by arbitration in manner and form according to the provisions for arbitration hereinbefore contained, and in the event of such option being so exercised the terms and provisions of the agreement of the 7th April, 1892, and of these presents shall extend and bind the parties hereto until the said period of twenty years shall have elapsed and expired, but the exercise of such option requiring such further renewal by the Lieutenant-Governor-in-Council shall not change, alter or affect the provisions in respect of the termination of the liberties, licenses, powers and authorities contained in paragraph 5 of the agreement of the 7th April, 1892, and so declared applicable at the termination of the said last mentioned or fourth renewal.

5. Paragraph 9 of the agreement of the 7th April, 1892, shall hereafter and henceforth be null and of no effect, it being agreed that the Commissioners will not themselves engage in making use of the water to generate electric or pneumatic power except for the purposes of the park, and saving the provisions contained in paragraph 12 of the agreement of the 7th April, 1892. Provided that in case the said Commissioners shall have granted to any other person or corporation license to use the waters of said Niagara or Welland rivers and by reason of failure of such person or corporation to carry on the work so licensed the said Commissioners find it necessary to forfeit said license and take over said works, this clause shall not prohibit said Commissioners from operating such works for the generation and transmission, sale or lease of electricity or power.

6. The provisions in paragraph 10 for the completion of the works therein specified are extended to the First day of July, 1903, and if not then completed the Lieutenant-Governor-in-Council may declare the agreement of the 7th April, 1892, and its variations by these presents, and also these presents, the liberties, licenses, powers and authorities so granted and every of them to be forfeited and void, and thenceforth after such declaration the same shall cease and determine and be utterly void and of no effect whatever.

7. So long as the agreement of the 7th April, 1892, as varied hereby, and these presents are in force, the Commissioners undertake and agree that the amount of rentals which may be fixed and charged for the right to use the waters of the Niagara or Welland Rivers within the Park for the purpose of generating electricity by any other company or person shall not be at less rentals than is provided and reserved by these presents, and, further, that any such company shall be subject to the like restrictions as in paragraph 11 of the said agreement of the 7th April, 1892. Provided, however, that notwithstanding anything in this paragraph contained, the rentals so to be fixed and charged against any other company or person may be reduced below the rentals provided and reserved by these presents so far only as such reduction may fairly and reasonably be allowed in respect of the increased cost of the construction of the canal or of canal and tunnel within the Park, by reason of its greater length or other ground of expense in its or their construction, whether required for supply or waste, through the Park to the point of discharge into Niagara River in excess of the distance between the power house of the Niagara River Power Company and the point of discharge into the Niagara River, such reduction not to be an amount sufficient to give any undue advantage as against the parties of the second part except by reason of such increased cost of canal or tunnel or both, as the case may be.

8. The Commissioners agree to grant as may be requested by the Company and the Niagara Falls Park and River Railway Company the right to use the waters of the Niagara River up to the 1st day of July, 1903, to generate electricity from the plant of the said railway company, or such other plant as the company may substitute for or add thereto under the agreement with the said railway company to be used beyond the Park and in such manner as is provided by the agreement of the 27th November, 1897, made between the party hereto of

the second part, as therein defined The Niagara Falls Park and River Railway Company, and the Commissioners party hereto of the first part, but the exercise of such powers, nor the quantity of power thereby generated shall not be allowed or taken to be in diminution of the quantity of power to be completed and had ready for use, supply and transmission as required by paragraph 10 of the agreement of the 7th April, 1892, as by these presents amended and extended and as to such electric power to be generated under the powers contained in the agreement of the 27th November, 1897, and to be extended in accordance with these presents as aforesaid up to the first day of July, 1903, it is hereby agreed that the powers and provisions contained in paragraph eleven of the agreement of the 7th April, 1892, shall apply to and form part of these presents up to the first day of July, 1903.

9. Nothing herein contained shall affect the provisions of the agreement of the 27th November, 1897, made between the Canadian Niagara Power Company, of the first part, the Niagara Falls Park and River Railway Company, of the second part, and the Commissioners of the Queen Victoria Niagara Falls Park, of the third part.

10. The said company shall not amalgamate with any other corporation or company heretofore or hereafter incorporated by or under the laws of the Dominion of Canada or by or under authority of the Province of Ontario or which shall be hereafter be licensed by the said Commissioners to take and use the waters of the Niagara or Welland Rivers or both for the purpose of generation and transmission of electricity without the consent of the Lieutenant-Governor in Council to such amalgamation, nor shall they enter into any arrangement or agreement for that purpose with any such company which may directly or indirectly have that effect, or which may or shall have the effect of keeping up the price or prices of said power, nor shall they enter into an agreement with any such company for pooling the receipts of the said company, or of any part thereof, with those of such other company, nor which shall provide for or have the effect of establishing a common charge or schedule of charges for the use of the said power or any part thereof.

11. It is further agreed that if from any cause the supply of water at the point of intake as by these presents defined be diminished, the company shall have no claim or right of action against the Commissioners, but may deepen such point of intake to such extent as to restore the supply of water to the volume or quantity necessary for the purposes of the company, and that the granting or licensing of rights to the company by these presents or the agreement of the seventh day of April, 1892, as hereby extended shall not give the company any right of action against the Commissioners. Nor give to the company any right of action against other licensees or grantees of the Commissioners in respect of any diminution not substantially interfering with the supply necessary for the company, nor so long as such necessary supply can be obtained by means of deepening at said point of intake.

12. And the said parties hereto mutually and respectively covenant, promise and agree with each other to carry into effect, perform and fulfil all the provisions and stipulations in these presents contained and to be carried into effect, observed, performed and fulfilled by the said parties respectively.

13. The provisions of the agreement of the 7th April, 1892, are to stand except where hereby expressly varied, and this agreement shall be read with the agreement of the seventh day of April, 1892, as though the two instruments formed one agreement.

14. This agreement shall have no force or effect until approved by the Lieutenant-Governor in Council.

In witness whereof the corporate seal of the Commissioners has been hereunto affixed by the chairman, who has signed the same: and the company has hereto affixed its corporate seal under the hands of W. H. Beatty, vice-president of the said company, and W. B. Rankine, secretary of the said company.

Corporate seal of the Canadian
Niagara Power Company.

Signed, sealed and delivered in
the presence of 'JAMES WILSON,'
As to the signatures of W. H. Beatty
and W. B. Rankine.

The Canadian Niagara Power Company,

By W. H. BEATTY,
Vice-President.

W. B. RANKINE,
Secretary.

Corporate seal of the Commissioners
for the Queen Victoria Niagara
Falls Park.

The Commissioners of the Queen Victoria
Niagara Falls Park,

By J. W. LANGMUIR,
Chairman.

Witness: JAMES WILSON,

As to signature of J. W. Langmuir.

APPENDIX D.

This agreement made this tenth day of April, one thousand nine hundred, between the Commissioners for the Queen Victoria Niagara Falls Park, acting herein on their own behalf and with the approval of the Government of the Province of Ontario, and hereinafter called the Commissioners of the first part, and The Fort Erie Ferry Railway Company, a corporation incorporated by the Legislature of the Province of Ontario and having no other existence or powers except by virtue of the said Legislature of Ontario; and hereinafter called the Company, of the second part.

1. The expression "The Commissioners" wherever it occurs herein shall be introduced to mean not only the parties hereto of the first part, but also their successors and assigns and those who for the time being may be the Commissioners of the Queen Victoria Niagara Falls Park, or any body, minister, or other, official to whom the Legislature of Ontario may appoint or require to discharge the duties or exercise the powers of the Commissioners.

2. The expression "The Company" wherever it occurs herein, shall be understood to mean the Company incorporated as hereinbefore mentioned, and its successors and assigns.

2 (a). The Company shall not be affected by any provisions in the Electric Railway Act contained, which may be at any time repealed—or be declared to be without the powers of the Legislature of Ontario; and section 9 relating to the acquisition of lands for parks; sections 18 to 26 inclusive; sections 36 to 38 inclusive, and sections 44 to 80 inclusive of the Electric Railway Act are declared to be inconsistent with the rights, powers and duties of the Company in respect of this agreement, and shall not apply thereto.

3. The expression "Chain Reserve" wherever it occurs herein shall be understood to mean, the land lying along the bank of the Niagara River situate in the Townships of Bertie and Willoughby, and County of Welland in the Province of Ontario, and extending from the Garrison Road in the village of Fort Erie to and including lot number 22, in the second concession in the Township of Willoughby, lying between those portions of the lots, heretofore granted by Letters Patent

from the Crown, and the waters edge of the River Niagara and including the Chain Reserve proper, as hereinafter defined.

4. The expression "Chain Reserve proper" wherever it occurs herein shall be understood to mean and include the highway as originally defined, or as now, or by these presents widened and substituted in front of, or upon the lots fronting on the Niagara River, or upon which the allowance for road along the river is laid and one chain in width.

5. The expression "the Railway" wherever it occurs herein shall be understood to mean a railway to be constructed, run and operated by electric power, and no different or other power, and to be constructed and laid upon the Chain Reserve proper.

6. Whereas the Company in pursuance of the powers and subject to the conditions in the Acts of the Legislature of the Province of Ontario contained, being about to build a railway between the village of Fort Erie in the County of Welland, to a point in or near the village of Chippewa, in the said County of Welland, the power of locating the same not being exercisable until the Company has obtained the approval of the Lieutenant Governor in Council to the construction of the said railway, and, in order to obtain such approval, the Company has applied to the Commissioners to secure the approval of the Government of Ontario, for the right of occupation of some parts of the Chain Reserve to construct the said railway thereon, as part of the railway to extend between the village of Fort Erie and the village of Chippewa.

7. And the Commissioners, acting on behalf of the Government of Ontario, with its approval, are prepared to license such occupation for the purposes aforesaid, upon the terms in this agreement mentioned and set forth.

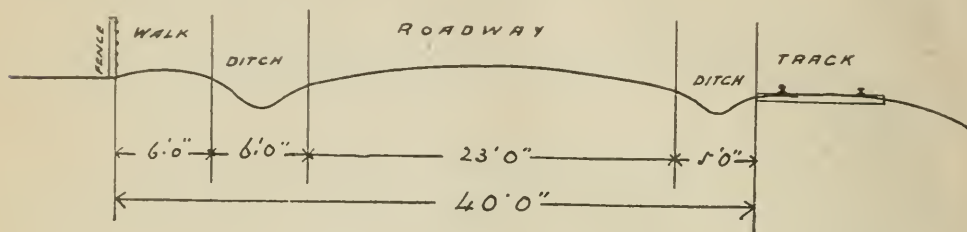
8. And whereas the provisions and conditions hereinafter set forth as agreed upon between the parties, some of which modify or change some of the provisions of Acts of the Legislature of the Province of Ontario, and together with other stipulations and conditions herein contained, will require the passing of an Act of the Legislature to confirm and declare the legality of this agreement as hereby agreed upon, or as the Legislature may deem proper to require, order, or declare.

9. And whereas the improvement and maintenance of the bank of the River Niagara between the above limits, so that the same shall be preserved against the wash of the river, and the preservation and continuance of highway facilities over the Chain Reserve, are among the considerations moving the Commissioners towards the making and entering into this agreement.

10. This agreement witnesseth and it is hereby agreed by the parties hereto, that between the point of commencement of the railway in the village of Fort Erie, viz:—to Slater's Point on the Niagara River, being in front of lot number twenty-two of the broken front of the Township of Willoughby, in the County of Welland aforesaid, the railway shall be laid on the east or river side of the Chain Reserve proper, on such line as the Commissioner of Public Works shall determine; and for that purpose shall be allowed 26 feet in width thereof, subject to the uses hereinafter specified, and measuring from the tracks of the railway on the west as the location of the railway is above defined. The space for unobstructed highway traffic shall not at any time during the continuance and existence of this agreement, or at any point, be less than 40 feet in width west of the western berm of the railway, except where lessened in the discretion of the Commissioner of Public Works as hereinafter provided, so that the common and public use for highways may pass freely over and along the highway as heretofore, between the farms and private lands on the one hand, and the railway on the other, subject to rights of passing over the Railway, as by law, or as herein-after specified.

11. The company in respect of the said highway within the width of 40 feet, shall grade, shape and roll the same to a hard finish for the entire distance

between the point of beginning of the railway at Fort Erie to Slater's Point on lot number twenty-two as and for a turnpike road, according to the cross-section shown herewith, providing sufficient cross-drainage of a permanent character, and providing all necessary bridges of the full width of the road as in the cross-section shown, namely, 23 feet width in clear :



11. (a) Between the northern boundary of the Village of Bridgeburg and Slater's Point, with the consent of the Commissioner of Public Works, at certain points by reason of circumstances of special difficulty, the normal width of 40 feet for highway as above provided may be lessened, and whatever land may be required to secure such width of 40 feet at any time during the continuance and existence of this agreement west of the western berm of the railway, excepting the special provision between the point of commencement in the Village of Fort Erie to the northern boundary of the Village of Bridgeburg, shall, if the same form any part of the land of proprietors (other than the commissioners) be procured by the company, by or under any powers which are exerciseable by this agreement, as confirmed by Act of the Legislature. Between the point of commencement and the northern boundary of the Village of Bridgeburg, the company shall not be required to expropriate land for widening the highway to the full width of 40 feet as hereinbefore stipulated.

12. Any land which may be required in order to make and maintain the highway of the full width above specified and defined, or wherever any land is required for such highway or railway, other than by the grant by the commissioners by these presents made, such land shall by such requirement become dedicated for use for highway purposes, or for railway purposes, as the case may be, in accordance with these presents, but the title thereof, if not so already, shall be made to the commissioners as and for the public uses of the Province, but subject to highway uses :

Fences, including gates, shall be erected by the company along the division or boundary line of the highway and the land of the proprietor, where land shall have been taken from the proprietor for the purpose of widening highway, within two months from the time of such taking, unless the proprietor shall by writing extend such time, such fences shall be of the same style as are upon and exist at the time of such taking, or the same fences shall be moved and re-erected, if such removal, including the gates, can be removed satisfactorily, and made not less good than previously to the taking as aforesaid.

13. The highway is now located or as may be placed on lands acquired for its improvement, including the part occupied by the railway, notwithstanding in whom the title to the soil and freehold may be vested, shall be under no control other than that of the municipalities within which its several parts are situate, in accordance with the provisions of the Municipal Act, except as by these presents varied.

14. Wherever there is or may be a public highway from the Chain Reserve proper to the water's edge of the Niagara River, the same shall continue as such and shall be kept open, maintained and repaired by the company during the existence of this agreement.

15. The railway tracks shall be subject to free passage over the same for highway purposes, and to the waters of the river for domestic purposes or watering stock, where such uses shall not trespass upon any private right; and all persons using the highway upon which the railway is laid, or adjacent, shall be at liberty to travel upon any portion of the highway occupied by the railway, provided that the running of the railway carriages or other conveyances of the company are not unduly impeded or interfered with in such running; and in all cases any carriage or other vehicle on the railway track shall immediately, by leaving the track, give place to the railway carriages or other conveyances of the company.

16. The rights of the company hereby granted or conferred, shall be subject to the exercise by the Government, of grants of passing over the railway, and granting access to the lands or water lots of Ontario along the bank, aforesaid, or bed of the Niagara River, for any purposes whatever; the rights of the company hereby granted or conferred shall also be subject to any grants, public rights, or private rights which may have been heretofore granted by the Dominion or any Provincial Government.

17. And this agreement further witnesseth as follows, that is to say, that for and in consideration of the matters hereinbefore contained, and the due execution by the company of the works thereby agreed by the company to be constructed and the lands to be acquired, and also of the rentals hereinafter reserved, and other provisions herein contained, the Commissioners do hereby license and permit the company to construct a first-class electric railway with single or double tracks over and upon the Chain Reserve proper, from a point in the Village of Fort Erie aforesaid at the steamer landing (nearly opposite to Forsyth Street) being in front of the Chain Reserve proper, thence along the Chain Reserve proper to that part of lot number twenty-two in the broken front of the said Township of Willoughby, in accordance with the provisoes, conditions, agreements, and recitals, in this agreement contained.

18. The said railway is to be four feet, eight and a half inches gauge, and is to be laid with steel rails of not less than 45 pounds to the lineal yard, fastened with fish plates, the formation, ballast, bridges and all other structures to be approved of by the Commissioner of Public Works for the Province of Ontario; for the purpose of electric light or electric power being used by consumers, the company shall have power to place wires upon the poles of the company used for transmission of the electric power required to operate the railway.

19. The company shall not erect any buildings or sheds upon the Chain Reserve without special permission of the Commissioners and shall not carry any work thereon that will in any way disfigure the Chain Reserve or River bank, of which works, whether disfiguring or not, the Commissioners are to be sole judges.

20. Nor shall the company encroach upon any part of the Chain Reserve proper with the object or for the purpose of constructing or building the railway or any part thereof upon the Chain Reserve proper, nor any part thereof until the formation and construction of the highway of forty feet in width, in accordance with the profile thereof, and the bridges of such highway shall have been completed to the satisfaction of the Commissioner of Public Works and ready for public use, and the acquisition of the land, which may have to be acquired for the width provided under this agreement, shall have been validly acquired and vested in the Commissioners as herein provided.

21. But so soon as the highway shall have been completed in accordance with the provisions of the next preceding paragraph, the company may commence the construction of the said railway whenever the plans and specifications thereof are approved in accordance with paragraph 35 of this agreement, but neither such approval, nor any other matter in this agreement contained is to affect the

observance by the company of all the provisions of the laws of Ontario, in so far as the same are applicable by virtue of any of the Acts of the Legislature of Ontario affecting the said railway.

The Commissioner of Public Works with a view to enable the building of the railway being expedited may define portions of the railway (the location and specifications whereof having been duly approved), the construction of which may be commenced before the whole of the highway has been completed, provided that contiguous to such defined portions of the railway, the land, if any required for widening the highway has been obtained, and that the public use of the highway contiguous to such defined portions of the railway shall not be obstructed or impaired.

22. The railway shall not be constructed, operated or worked upon the Chain Reserve proper, or its traffic thereon arranged so as to impede or incommode the public use of any street, highway, or public place as little as possible, and so as not to be a nuisance thereto, nor to interfere with the free access to any house or other building erected in the vicinity of the same, nor to endanger the same.

23. The license hereby granted is for the term of twenty-one years, commencing with the first day of January, nineteen hundred and one, the company paying therefor to the Commissioners the clear yearly rental of (\$1,000) one thousand dollars during the first seven years (the rent to be computed from the first day of January, 1901. The rental for the eighth, ninth and tenth years of the term to be twelve hundred dollars for each year, the rent for the eleventh to the fifteenth years of the term inclusive to be fifteen hundred dollars for each of the said five years, and the rent for the sixteenth to the twenty-first year of the term inclusive to be two thousand dollars for each of the said six years. The said rentals to be paid in four equal quarterly instalments, on the first day of the months of April, July, October and January, in each and every year, the first payment shall be due and payable on the first day of April 1901; and all such payments shall be made to the Commissioners quarterly as aforesaid, whether the railway be completed or not.

24. The rent shall be paid, although the company may not by virtue of this agreement be able to exercise the rights and powers to construct and operate the said railway, it being understood that the Commissioners do not guarantee the rights, interests, and franchises hereby conveyed to the Company, and do not covenant for the quiet enjoyment thereof, except as against the acts of the Commissioners and their successors, and any one claiming by, through or under them.

25. At the end of the term of twenty-one years, to be computed from the first day of January 1901, the said term shall be renewable on the request by the Company for a further period of twenty-one years as may be agreed upon, or as hereinafter provided.

26. At the end of the said first term or period of twenty-one years, the Commissioners shall demand from the Company for the further period of twenty-one years the payment of a greater clear annual sum than the sum of two thousand dollars as rental for each year of the said further or second term or period of twenty-one years, then if the parties hereto cannot agree as to the same, the amount to be paid for such further period, not less than the amount of two thousand dollars for rental for each year of such further period, shall be ascertained by three arbitrators or a majority of them, one of whom shall be named and appointed by the Commissioners, another by the Company (the parties hereto of the second part) and the third by the Chief Justice or senior presiding Judge of the Provincial Court of ultimate appellate jurisdiction for Ontario. The proceedings of and before such arbitrators shall be subject to the provisions of law

relating to "References by consent out of Court" contained in the Revised Statute of Ontario 1897, Chapter 62, respecting arbitration and references. Either party to such arbitration may appeal in accordance with the provisions of the aforesaid Revised Statute respecting arbitration and references.

27. If the Company desire to renew for such further period of twenty-one years, notice of such desire to renew shall be given by the Company to the Commissioners in writing at least twelve months before the expiration of the first term or period of twenty-one years.

28. If at the end of the said first period of twenty-one years, the Company decline or are unwilling to renew, or at the end of the second period of twenty-one years, if the Company continue to hold for such second period, the Company shall be duly compensated by the Commissioners for their railway machinery and other works between the points over which the same is licensed to be constructed by virtue of this agreement and being in and upon the lands under this agreement licenses including the equipment, but not in respect of any franchises for holding or operating the same, such compensation to be fixed by mutual agreement, or in case of difference by arbitration as in paragraph 26 of this agreement, but the failure before the expiration of any such term to fix such compensation in manner aforesaid, or to pay before such expiration, the amount of compensation so fixed, shall not entitle the Company to retain possession meanwhile of the said railway, equipment, machinery and works, by this agreement to be constructed or operated, but the same shall nevertheless and notwithstanding that the Commissioners may have taken possession thereof, remain subject to such liens and charges save as to possession as aforesaid, as may exist in favor of bond-holders or debenture holders of the Company, and the Company shall retain a lien or charge thereon, save as to possessions as aforesaid, for compensation of their railway equipment, machinery and works to be agreed upon as aforesaid or so to be awarded to them, provided however, that all such liens and charges shall not exceed the amount that may be agreed upon or may be awarded for such compensation as aforesaid.

29. The compensation to be made to the Company in respect to the matters contained in the next preceding paragraph of this agreement, according to its provisions under the contingencies therein specified, shall include the prices paid to the proprietors of the lands to be acquired to build the railway, and to restore or widen the Highway, which the Company will have to acquire, and which the Commissioners do not now hold, and also the amount actually paid for grading and making the Highway and its bridges, in accordance with the provisions and specifications contained in paragraph 11 of this agreement.

30. The particulars of the prices paid for land, and the amount paid for making the Highway and its bridges shall be furnished to the Commissioners within six months after the same shall have been paid by the company.

For all railway equipment, machinery and works provided, and the amount expended during the continuance of this agreement, and its term of extension if extended under its provisions and which has been expended in each year, the Company shall annually furnish to the Commissioners particulars of such expenditure, and if not furnished within one year after expenditure, such expenditure shall not form an item or outlay for which the Company at the expiration of this agreement or the extension thereunder shall be compensated, but no interest on any of the foregoing expenditures or outlays shall be claimable by the Company or recoverable as part of the compensation to be paid or allowed, and the valuation of the Railway and works done, and equipment, shall be upon the condition of such Railway and Works and their actual value at the expiration of this agreement.

31. The rents hereby agreed to be paid are hereby declared to be and shall be the first and preferential charge upon the railway and works, and the Company shall not create any lien, charge or encumbrance upon the railway or works, or any of them by bond, debenture, mortgage or otherwise, nor suffer any mechanic's lien to be created, which will interfere with or prevent the Commissioners from procuring payment of the rent hereby reserved, or any part thereof, and no simple contract creditor or any other creditor of the Company is to have any claim against the railway or works, or any part thereof, in priority to the claim of the Commissioners for rent.

32. Provided always that if any of the rent, whether payable under paragraph 23 of this agreement, or in respect of the renewal term in the paragraphs subsequent and supplementary thereto, shall be in arrear for three months, whether legally demanded or not, the Commissioner, or if not then an existing Corporation, the Government of the Province of Ontario may enter into and upon the Railway or any part thereof in the name of the whole, and thereupon this agreement shall terminate and the remainder of the term then current shall terminate as well as the renewal thereof, which under this agreement may be claimed.

33. In respect of all rights and authorities which the Commissioners by this agreement have conferred or have agreed to confer upon the Company to exercise in and about the execution of the works to be constructed, and operating and working the same, or of all other matters of any kind whatever herein agreed upon, the company will indemnify the Commissioners in respect of the exercise of said rights by the Company, or of any acts done by the Company in pursuance of any of the matters herein contained, and will hold the Commissioners free from any liability to any person or persons whomsoever.

34. AND PROVIDED that should the Title of the Commissioners, or of the Crown, to any portion or portions of the lands hereby licenses to be occupied by the Company found to be defective, neither the Company nor its successors or assigns shall have any claim in respect thereof by virtue of anything contained in these presents.

35. The Company shall not commence the construction of the Highway or the Railway or any work thereunto appertaining, until it has submitted to the Lieutenant-Governor-in-Council plans of the location of such Highway, and of the profile thereof, as such Highway is proposed to be widened and of all the intended works and bridges thereunto appertaining, and the approval of the Lieutenant-Governor-in-Council obtained, nor until the plans and specifications of the Railway have been approved by the Lieutenant-Governor-in-Council.

36. The construction, widening and grading of the highway shall be commenced within two years, and the railway within three years, and the whole completed within five years from and after the date of this agreement, and if the said works are not commenced and completed within said times, then the powers in this agreement, provided and granted shall cease and be null and void.

37. The Company covenants, promises and agrees with the Commissioners to carry into effect, observe, perform, and fulfil all the provisions and stipulations in these presents contained, and to be carried into effect, observed, performed and fulfilled by the Company.

38. This agreement shall have no force or effect until confirmed by an Act of the Legislature of the Province of Ontario.

In witness whereof the corporate seal of the Commissioners has been hereto affixed by the Chairman who has signed this agreement and duly authorized for all purposes hereof by resolution of the Board of Commissioners duly passed on the eleventh day of April, 1900, and the company acting by and through its

President and Secretary duly authorized for all purposes hereof by resolution of the Board of Directors of the said Company duly passed on the ninth day of April, 1900, has hereunto affixed its Corporate Seal under the hands of the President and Secretary.

Fort Erie Ferry Railway Company
Corporate Seal.

(Sgd.) W. H. DAVIS,
President.
(Sgd.) WM. WHARTON,
Secretary.

Signed, sealed and delivered by the President
and Secretary of the Fort Erie Ferry
Railway Company in presence of
JAMES WILSON.

The Commissioners of the Queen
Victoria Niagara Falls Park.

The Queen Victoria Niagara Falls Park
Corporate Seal.

J. W. LANGMUIR,
Chairman.

APPENDIX C.

The Ontario Power Company of Niagara Falls, agreement of April 11th, 1900, with the Commissioners for the Queen Victoria Niagara Falls Park. Statutes of Canada : 1887, chapter 120 ; 1891, chapter 126 ; 1893, chapter 89 ; 1899, chapter 105. Approved by the Lieutenant-Governor in Council, 1900.

This agreement made this eleventh day of April, 1900, between the commissioners of the Queen Victoria Niagara Falls Park, acting herein on their own behalf and with the approval of the Government of the Province of Ontario, and hereinafter called the "Commissioners" of the first part, and, The Ontario Power Company of Niagara Falls incorporated by the Parliament of Canada under and by virtue of Act 1887, 50-51 Victoria, chapter 120 ; Act 1891, 54-55 Victoria, chapter 126 ; Act 1893, 56 Victoria, chapter 89 ; Act 1899, 62-63 Victoria, chapter 105, hereinafter called "the Company," of the second part.

And whereas the company are desirous to exercise the powers, which by and under the hereinbefore recited Acts of the Parliament of Canada or either of them have been conferred upon the Company.

And whereas for convenience and to prevent ambiguity, it is agreed and understood by and between the said parties hereto, and is hereby declared as follows, that is to say :

- (a) The expression "the park," whenever it occurs herein, shall be understood to mean the park proper, namely the Queen Victoria Niagara Falls Park south of its original boundary in front of the Clifton House and running easterly to Niagara River.
- (b) The expression "the Commissioners," wherever it occurs herein, shall be understood to mean not only the Commissioners of Queen Victoria Niagara Falls Park, as representing the Government of the Province of Ontario in the premises named as parties hereto of the first part, but also their successors and assigns and those who for the time being may be the Commissioners of the Queen Victoria Niagara Falls Park, or other representatives of the Government of Ontario in the premises.
- (c) The expression "the Company," whenever it occurs herein shall be understood to mean The Ontario Power Company of Niagara Falls and its successors and assigns as incorporated and described in and by the several Acts of the Parliament of Canada, hereinbefore mentioned.

And whereas in and by the said in part recited Acts of the Parliament of Canada, the Company is empowered to construct, equip, maintain and operate a canal and hydraulic tunnel from such point in the Welland River at or near its conjunction with the Niagara River, to a point or points on the west bank of the Niagara River about or south of the Whirlpool (and from a point or points in the Niagara River at or immediately south of the head of the rapids near the Welland River, to a point or points on the west bank of the Niagara River about or south of Clark Hill), with all such works, dams, and wing dams, docks, conduits, accessories and buildings as may be necessary to give full effect to the intent of the aforesaid Act of Canada 1887, 50-51 Victoria. Chap. 120, and whereby it is provided that none of the works authorized by the said Act, or the amendments thereof, shall be commenced until plans thereof have been submitted to the Minister of Railways and Canals, and his sanction thereto has been obtained.

And whereas by the said in part recited Acts it is further provided "none of the works authorized by the said chapter 120 of the Statutes of 1887 or by any other Act relating to the Company or by this Act shall be constructed within the limits of the Queen Victoria Niagara Falls Park; and none of the powers given by such Acts or either of them, shall be exercised within the limits of the said Park, except with the consent of the Lieutenant-Governor of Ontario in Council, and of the Commissioners of the said Park."

And whereas by the said in part recited Acts; section 7 Plans and Surveys, and section 8 Lands and their valuation, with other sections of *The Railway Act*—R.S.C. c. 109, in the said in part recited Acts mentioned are made applicable to the works by the said in part recited Acts authorized to be constructed or operated.

And whereas by section 27 of the first of the said in part recited Acts it is enacted:

"The Company may take and make the surveys and levels of the land upon, through, or under which, the said works are to pass or be operated, together with the map or plan thereof, and of the course and direction of the said canal or tunnel, and of the other works, and of the lands intended to be passed through or under so far as then ascertained, and also the book of reference for the works, and deposit the same as required by *The Railway Act* with respect to plans and surveys, by sections or portions less than the whole length of the said canal or tunnel authorized, and of such length as the Company, from time to time, see fit; and upon such deposit as aforesaid, of the map or plan and book of reference, of any and each of such sections or portions of the said canal, all every of the clauses of *The Railway Act* applied to, included in, or incorporated with this Act, shall apply and extend to any and each of such sections or portions of the said canal or other work authorized, as fully and effectually as if the said surveys and levels had been taken and made of the lands through, or under which the whole of the said canal and tunnel is to pass, together with the map or plan of the whole thereof and of their whole course and direction, and of the lands intended to be passed through or under and taken or affected and as if the book of reference for the whole of the said canal and tunnel had been taken, made, examined, certified, and deposited according to the said clauses of *The Railway Act* with respect to plans and surveys."

And whereas the Company pending submission to the Minister of Railways and Canals of the plans and surveys of the works authorized by the said in part recited Acts for his sanction, have submitted to the Commissioners a plan or map of such part of the Park intended to be taken, and upon, through, or under which, the said works are intended to pass or be operated, and have proposed to the Commissioners terms and conditions for their consent thereto whereby the powers of the Company may be exercised within the limits of the Park and the Commis-

sioners subject to the sanction of the Minister of Railways and Canals duly obtained, and other compliances with the terms of the Acts as hereinbefore recited, being duly observed and performed; and subject always to the consent thereto of the Lieutenant-Governor of Ontario in Council, in respect of such proposals have agreed.

As these presents witness :—

1. Should the Minister of Railways and Canals, upon the submission to him of the plans of the works proposed for his sanction as hereinbefore recited, require such plans to be varied or altered in any manner which the Commissioners may deem material, then such variations or alterations will be subject to the assent or dissent of the Commissioners, and in giving assent the same may be on such conditions as may be agreed on by an agreement supplementary hereto.

2. That the plans and surveys to be submitted to the Minister of Railways and Canals above mentioned, for his sanction, shall be not only of the works of the Company within the limits of the Park, but of the course and direction of the canal to lead the waters from the Welland River, at and from some point between Chippewa and Montrose, whereby said waters may be discharged into the Niagara River.

Provided that after such sanction as aforesaid shall have been obtained, it shall not be open to the Commissioners to object that the capacity and width of the canal as may be at first defined, outside the Park or for discharge into the Niagara River, and submitted for sanction as aforesaid, may not from time to time be widened under the sanction of the Minister of Railways and Canals, with the view of increasing the supply or discharge of water by the Company—but within the Park shall not be widened beyond the limits defined in a certain plan hereinafter mentioned.

And whereas the Commissioners have consented to the construction of works and the exercise of powers by the Company within the Park, subject to the provisions and reservations as hereinbefore recited, for the considerations and upon the conditions hereinbefore and hereinafter expressed and contained or intended so to be.

Now therefore this agreement further witnesseth and it is hereby agreed by the parties to these presents, as follows, that is to say :—

3. The Commissioners hereby irrevocably license the Company, subject to the provisions and considerations herein more specifically set forth and save as hereinafter limited to construct and operate within the Park the works necessary for the purposes of the Company, and which may be particularly described as follows :—

(a) To excavate an open channel or head race through the high bank forming the western boundary of the Park for the purposes of conducting the water from the Welland River to the site of the Company's works.

(b) To construct a forebay or reservoir immediately in the line of the head race and adjoining the high bank with all necessary dams, revetment walls, penstocks, gates and all appliances for containing and regulating the flow of water.

(c) To erect a power house for the machinery needed to utilize the head of water available at this point, and in which to generate the electric or pneumatic power required, said power house to be located within the limits as shewn on the map hereto attached.

(d) To make an open tail race from the power house to the Niagara River.

(e) To construct such other works as may be necessary for making the power plant complete in all its details.

THE WORKS ABOVE DESCRIBED MAY BE KNOWN AND DISTINGUISHED AS THE
FIRST DEVELOPMENT.

4. All the works to be done and executed by the Company in order to carry out the work of this first development, and the manner in which the same may from time to time be proposed to be performed or varied, shall before being commenced be submitted by the Company to the Commissioners, accompanied by suitable plans, profiles, specifications, and elevations as the case may require, and the scenic features thereof shall be approved by the Commissioners in writing. This approval shall in no wise relieve the Company from responsibility for the stability and effectiveness of its works, but it is intended to secure as far as possible a degree of harmony in the outline and treatment compatible with the location and with the works in a public Park. The works to which such approval may be given are the following:—

(a) The slopes of the cuttings and embankments for the canal and forebay, together with the precautions taken to prevent overflow or flooding Park territory.

(b) The power house and means of access thereto.

(c) The tail race for spent water, with bridges to carry the Park driveways and the Niagara Falls Park and River Railway tracks over the same.

(d) The depositing of excavated and surface material within the Park area.

5. Before commencing its work in the Park, the Company shall remove all good service soil from the area to be disturbed, and deposit the same in heaps at convenient points as the Commissioners may direct, to be used as a top dressing for embankments and slopes, as all other materials which may be taken from the excavations of the Company and authorized to be deposited within the Park.

6. Material other than the good top soil above referred to, which may be excavated from the works of the Company in the Park, shall be used for filling out into the Niagara River to a line shown on the map or plan "A" attached hereto and marked "line to which excavated material shall be deposited," and extending from the Suspension Bridge leading to Dufferin Islands northwards as far as the outlet of the tail race of the Company. Before depositing this material the Company shall first construct a substantial and efficient crib work facing, of the same general character and dimensions as that built by the park over a part of this distance, in order to protect the filling from being eroded by the action of the river, the heights, lines, slopes and levels of this filling to be defined by the Commissioners.

7. Any excess of waste or refuse materials taken from the excavations of the head race, forebay, tail race and power house not required to complete the filling into the river above mentioned, may be used in raising the levels of the grounds to the south of the tail race to such an extent of ground and to such levels and slopes as the Commissioners may determine—all such filling shall be brought to its proper grade and covered over with the good surface soil previously stripped off as described, and finished ready for seeding down or planting. Should there be any materials in excess of what is needed for the embankments of the forebay or for the above mentioned purposes it shall be taken away by the Company and deposited outside the Park.

8. For the purposes of construction and to remove or receive supplies of materials and machinery, the company may build, subject to the approval of the Commissioners, tramways, and such other appliances and structures as may be necessary for the prosecution of the work; but these appliances are to incommode to the least possible extent the ordinary travel in the Park, and shall be removed as soon as the works for which they are required are completed.

9. The Company shall provide and construct two drive-way bridges across the tail race, at such points as the Commissioners shall determine: such bridges to be of steel, of appropriate design, not less than twenty feet width of roadway, and with five feet pathway on each of the two sides.

During construction of works, temporary wooden bridges to carry the drive-way traffic, substantial construction are to be provided and maintained by the Company where directed by the Commissioners.

10. The sides of the tail race shall be constructed in a permanent manner, and so as to secure the banks against erosion. Above high water level, the slopes shall be sodded and protected by a substantial iron railing to the approval of the Commissioners.

11. The Company undertake before commencing any works or excavation or construction within the Park limits to have actually expended upon the works of the canal or head race from the Welland River outside the Park bounds, not less than fifty thousand dollars exclusive of cost of land and work heretofore done.

Provided that should the Company before expending the said fifty thousand dollars upon their works outside the Park, desire to commence the work upon that portion of their works within the limits of the Park marked "Forebay," "embankment," and open head race from Welland River" on the plan A hereto annexed they shall be at liberty to do so upon depositing with the Commissioners the sum of fifty thousand dollars in cash as security that the Company will, after commencing such work, duly carry on the same up to and beyond the Park limit until the work done outside the Park amounts to not less than fifty thousand dollars and to be expended within two years from the time of the commencement of the work by the Company within the Park.

The said fifty thousand dollars to be deposited by the Commissioners in a chartered bank at such interest as the bank may allow: and as the work outside the Park progresses the said sum is to be returned to the Company in amounts equal to the value of the work actually done from time to time outside the Park on fortnightly certificates of an engineer approved of by the Commissioners showing the value of such actual work from time to time. But if, after commencing the said work within the Park, the Company makes default for the period of two years from the time of such commencement in duly carrying on the said work within the Park as above particularly described and shall extending the same without the Park so that the work actually done outside the Park within such period of two years amounts to fifty thousand dollars, then at the end of the said period of two years, the said fifty thousand dollars deposited with the Commissioners, or so much thereof as may not have been paid over on said certificates shall be forfeited.

12. The works in the park, when begun, shall be prosecuted vigorously, and brought to a completed state with as little delay as possible, and the Company undertake to complete all the filling up, grading, levelling, sodding and other works affecting the surface of the park as hereinbefore provided, and to have removed all tramways and other constructions, materials or appliances used in carrying out the operations of the Company in its first development within the time provided for the completion of the works themselves.

SECOND DEVELOPMENT.

13. The Company shall further have the right at any time upon notification to such effect to the Commissioners in writing to construct works for conducting the water to be brought as hereinbefore described to the first development, by means of an open canal or head race excavated in the park, from the power house

aforesaid to a point distant 100 feet south of the southerly line of the table rock house, and the location of which open canal as indicated on said plan marked "A" the Commissioners hereby approve, thence by an underground channel or covered forebay northwards as far as the Dufferin Cafe, and by means of penstocks from this underground channel or covered forebay to conduct the waters aforesaid to a second power house situate in the gorge below the falls, and north of the present hydraulic elevator, the whole as shown in yellow lines upon the map attached marked "A."

14. The plans of the company shall provide for construction of works of a substantial and permanent character. The said canal shall not be greater in width at the water surface than is indicated on said plan. The works below high water level shall be built in a substantial manner, the side slopes above high water level to be neatly graded and sodded, and the whole to be of such construction as to prevent leakage that will in anyway cause damage. Two steel drive-way bridges on stone abutments are to be provided by the Company to carry the park travel over the canal at points to be defined by the Commissioners.

15. Should it be found necessary to provide means for passing floating ice from the open canal, the Company may construct an ice run as shown on plan—the sides to be walled in masonry and bridges to be provided to carry the drive-way and railway traffic in the manner and under the authority stipulated for the works of the tail race of the first development.

16. All the materials to be excavated in the construction of this open canal may have to be removed from the park and deposited without its bounds, unless the Commissioners find that a greater or lesser quantity may be used in the park at points convenient to the work, in which case the Company shall deposit, grade and slope the same in the manner provided for the material taken from the works of the first development.

17. The underground channel or covered forebay shall be so constructed as to permanently sustain a dead load of one and a half feet of surface soil and a moving load of 50 pounds to the square foot in addition.

18. The underground channel or covered forebay, and the penstocks or flumes are all to be made as nearly as possible water tight. Stone walls or other objectionable features shall not be exposed to view above the finished surface of the park.

19. The power house in the gorge to be compact and designed with special reference to its position. Its architectural features, coloring and otherwise, shall be to the approval of the Commissioners, and the method of disposing of tail water overflow, ice runs the changing of the talus and the erection of a service elevator, etc., shall be to their approval.

20. All materials required in the construction or equipment of this power house, penstocks, or flumes, etc., shall be brought on the ground and put in place in such a way as to interfere with or obstruct to the least possible extent the park driveway leading to table rock.

Steam power for drilling, excavating or hauling materials or drawing machinery required in the construction of the covered forebay or penstocks shall be used in the park as little as possible, preference being given to compressed air or electricity.

21. The company shall carry on all the works of the second development with such expedition that the excavations and constructions which may be upon the upper level shall be completed within two years from the time of commencement, and the works in the lower level within three years, but this shall not prohibit the company from constructing the covered forebay in three sections

and lower power house with penstock connections in several sections, with like limits as to time in each case, should it be found desirable so to do, nor from deepening the canal at any time. Excavated or refuse material taken out of the talus slope in building the power house for the second development may be distributed at some point or points below the cliff, as the commissioners may from time to time point out, but shall not be required to be covered with the good soil.

22. The Company shall further have the right at any time, upon notification of the Commissioners in writing to such effect, to extend the power house and forebay of their first development and to widen out the tail race to the Niagara River, as in indicated in dotted yellow lines on the map hereto attached marked "A". Said work of extension shall be undertaken and completed and the Park grounds left in a finished condition within the space of two years after such notification to the Commissioners.

23. All the material and machinery required in construction and equipment shall be brought on the ground in such a manner as to incommode to the least possible extent the ordinary traffic of the Park

24. The character of the work in this extension shall correspond in all respects to those of the first development. None of the materials which may require to be excavated or removed in the execution of this extension may be deposited within the Park, but the whole, together with all debris and unused building materials brought on the ground, must be taken away and desposited without the Park bounds, unless permission is granted by the Commissioners to deposit such materials within the Park.

And this agreement further witnesseth :

25. The Commissioners, subject to the sanction of the Minister of Railways and Canals to the plans and consent of the Lieutenant-Governor of Ontario to this agreement as hereinbefore set forth, hereby signify their consent to the location of the said works within the Park and adjacent thereto, as outlined and shown in pink upon the plan or in other colored lines or explanations thereon noted and attached hereto; such map or plan being marked "A," and submitted by the Company to the Commissioners, as hereinbefore stated, and is a duplicate of so much of the map or plan of the lands intended to be taken, passed through or over within the Park, to be submitted to the Minister of Railways and Canals for his sanction. The said map or plan marked "A" is identified by the seals and signatures of the parties hereto: Provided always that the provisions of the statutes applicable to the Company with respect to crossing the line of the Niagara Falls Park and River Railway Company, as in all other matters in the said statutes contained shall be duly complied with by the Company.

26. The license hereby granted is for the term of fifty years, commencing with the First day of April, 1900, the Company paying therefor a clear yearly rental of \$15,000, payable half yearly on the First days of October and April in each year, and in addition thereto payment at the rate of the sum of \$1.00 per annum for each electrical horse-power generated, and used or sold or disposed of over ten thousand electrical horse-power up to twenty thousand electrical horse-power, and the further payment of the sum of 75 cents for each electrical horse-power generated and used and sold or disposed of over twenty thousand electrical horse-power up to thirty thousand electrical horse-power, and the further payment of the sum of fifty cents for each electrical horse-power generated and used and sold or disposed of over thirty thousand electrical horse-power; that is to say, by way of example, that on generation and use and sale or disposal of thirty thousand electrical horse-power the gross rental shall be \$32,500 per annum, payable half yearly, and so on in case of further development as above provided, and that such

rates shall apply to power supplied or used either in Canada or the United States. Such additional rentals as shall be payable for such generation and sale, or other disposition as aforesaid, to the Commissioners shall be payable half yearly at the rate above specified on the First days of October and April in each year for all the power sold in the said several half-yearly periods from the day of sale ; and within ten days after the said first days of October and April in each year on which such additional rentals shall be payable respectively the treasurer, or if no treasurer the head officer of the Company, shall deliver to the Commissioners a verified statement of the electrical horse-power generated and used and sold or disposed of during the preceeding half year, and the books of the Company shall be open to inspection and examination by the Commissioners, or their agent for the purpose of verifying or testing the correctness of such statement ; and if any question or dispute arises in respect to such return, or if any statement delivered at any time by the Company to the Commissioners of the quantity or amount of the electrical horse-power generated and used and sold or disposed of, or of the amount payable for such additional rentals, the High Court of Justice of Ontario shall have jurisdiction to hear and determine the same and to enforce the giving of the information required. The Company has paid, contemporaneously with the signing of this agreement, the sum of \$30,000, being the first two years rental in advance, (being up to 31st March, 1902.)

Provided always that if any part of the said rent, whether payable under this paragraph, or in respect of the renewal term or terms in the following paragraph, shall be in arrears for three months whether legally demanded or not, the Commissioners, or if not then an existing corporation, the Government of the Province of Ontario, may re-enter on the premises, or any part thereof in the name of the whole and thereupon this agreement shall determine, and the remainder of the term then current shall terminate as well as any renewal or renewals thereof which under this agreement may be claimed.

27. If at the end of the said period of fifty years the company desire to renew for a further period of twenty years, and shall give notice in writing to the Commissioners at least twelve months before the expiration of the fifty years period, they shall be entitled to and shall receive a further lease of such rights for the period of twenty years more at the same rental as above provided, unless the Lieutenant-Governor-in-Council shall desire a readjustment of said rent as below provided, and similarly the Company shall be entitled at their option to two further renewals of twenty years each at same rental, subject to the same qualifications, the object and intention of this stipulation being to confer upon the company the right to an original term of fifty years at the rentals hereinbefore specified, and to three further terms of periods of twenty years each at said rentals, making one hundred and ten years in all, and the company shall then give up, or at the expiration of the first term of fifty years, or any subsequent term of twenty years, if unrenewed in accordance with this agreement the works, premises, rights and privileges by this agreement created without any claim for compensation with liberty to the company to remove their machinery. In case the company desire to terminate the lease, they may do so during the first period of fifty years upon three months notice in writing to the Commissioners, or in case the Commissioners are not then an existing corporation, the Government of the Province of Ontario, payment of rent up to the time of the termination of such notice being made upon the giving of such notice. At the end of said period of fifty years the same rental as are hereby reserved shall continue to be paid by the said company unless the Lieutenant-Governor-in-Council shall desire a readjustment of the said rent, in which case the rentals for a further period of twenty years shall be readjusted by agreement, and in the absence or failure of agree-

ment by the parties hereto then the rentals for such further term shall be ascertained by three arbitrators or a majority of them, one of whom shall be named and appointed by the Commissioners, another by the company, and the third by the Chief Justice or senior presiding Judge of the Provincial Court of Ultimate Appellate Jurisdiction for Ontario. The proceedings of and before such arbitrators shall be subject to the provisions of the law relating to "References by consent out of Court," contained in the Revised Statutes of Ontario, 1897, chapter 62, respecting Arbitrations and References; and either party to such arbitration may appeal in accordance with the provisions of the said Revised Statute. The Lieutenant-Governor-in-Council may in the like manner for the two further periods of twenty years each require a readjustment of said rentals. In which case the same shall be determined as aforesaid and at the expiration of such two periods of twenty years each the term so limited by these presents shall determine and end in accordance with all provisions above contained whereby the company shall then give up the works, premises, rights and privileges by this agreement granted or created without any claim for compensation, but with liberty to the company to remove their machinery. And it is hereby further agreed that at any time not less than three years before the period at which such third renewal of twenty years shall terminate the Lieutenant-Governor-in-Council, and notice thereof to the Company given, may require the company to continue its operations for a further period of twenty years, to commence from the termination of such third renewal, at the same rental as shall have been paid during the said third renewal period of twenty years or at a readjustment of said last mentioned rental's for such further period of twenty years by agreement, and in the absence or failure of agreement by the parties hereto, then the rentals for such further term of twenty years shall be ascertained by arbitration in manner and form and according to the provisions of arbitration hereinbefore contained, and in the event of such option being so exercised the terms and provisions of these presents shall extend and bind the parties hereto until the said period of twenty years shall have elapsed and expired, but the exercise of such option requiring such further renewal by the Lieutenant-Governor-in-Council shall not change, alter or effect the above provisions in respect of the termination of the liberties, licenses, powers and authorities, and so declared applicable at the termination of the said last mentioned or fourth renewal.

28. The Commissioners will not themselves engage in making use of the water to generate electric, pneumatic or other power except for the purposes of the park, provided that in case the said Commissioners shall have granted or at any time may have granted to any other person or incorporation license to use the waters of the said Niagara or Welland rivers, and by reason of failure of such person or corporation to carry on the works so licensed the said Commissioners find it necessary to forfeit said license and take over said works, this clause shall not prohibit said Commissioners from operating such works for the generation and transmission, sale or lease of electricity or power.

29. The Commissioners shall not be responsible for any damages to person or property caused by the company in the construction or operation of its works, and the company shall hold the Commissioners safe and harmless from liability for all damages so caused.

30. For the transmission of electricity or pneumatic power to points beyond the park in Canada or the United States the Company shall have the right to convey the same by wires, cables, pipes or other appliances in conduits, beneath the surface of the park at such depth and in such locations as the Commissioners may from time to time determine, including the right to cross the so-called chain reserve so far as the same is within the jurisdiction of the Commissioners at any point or points approved of by the Commissioners between Fort Erie and Niagara-

on-the-Lake, but subject to any rights which the Commissioners may have created or licensed or which may be created, without prejudice however to the exercise by the company of any of its rights and powers.

31. The Company undertake to begin the works hereby authorized within two years from the date of this agreement and to have proceeded so far with the said works on or before 1 April, 1906, that they will have completed within the Park water connections (that is to say: headrace, forebay, penstocks and tail race) for the development of twenty-five thousand horse power and have actually ready for use, supply and transmission ten thousand developed electrical or pneumatic horse power by said last mentioned day, and if not then completed the Lieutenant-Governor-in-Council may declare this agreement, the liberties, licenses, powers and authorities so granted and every of them to be forfeited and void, and thenceforth after such declaration the same shall cease and determine and be utterly void and of no effect whatever.

Provided always that unless the Company has on or before the tenth day of July, 1902, completed the works capable of delivering at least fifteen thousand horse power, or unless the time for the completion of such works limited by section 2 of chapter 105, Dominion Statutes of 1899, is duly extended by the Parliament of Canada, the Lieutenant-Governor-in-Council may on and after the tenth day of July, A.D. 1902, declare this agreement and the liberties, licenses, powers and authorities hereby granted, and every of them, to be forfeited and void, and thenceforth after such declaration the same shall cease and determine and be utterly void and of no effect whatever.

Provided always that no extension of time by the Parliament of Canada shall extend or affect the time for completion under this agreement beyond the first day of April, 1906.

32. So long as this agreement is in force the Commissioners undertake and agree that the amount of rentals which may be fixed and charged for the right to use the waters of the Niagara or Welland rivers within the Park for the purpose of generating electricity by any other Company or person shall not be at less rentals than is provided and reserved by these presents, and further, that any such Company shall be subject to the like restrictions as in paragraph 33 of this agreement. Provided, however, that notwithstanding anything in this paragraph contained the rentals so to be fixed and charged against any other Company or person may be reduced below the rentals provided and reserved by these presents so far only as such reduction may fairly and reasonably be allowed in respect of the increased cost of the construction of the canal within the Park, or of the canal and tail race or tunnel within the Park, by reason of its greater length or other ground of expense in its or their construction, whether required for supply or waste, through the Park to the point of discharge into the Niagara River in excess of the distance between the power house of the Canadian Niagara Power Company and the point of discharge into the Niagara River, such reduction not to be of an amount sufficient to give any undue advantage as against the parties of the second part except by reason of such increased cost of canal or tail race (or tunnel), or both, as the case may be.

33. The Company whenever required shall, from the electricity or pneumatic power generated under this agreement, supply the same in Canada to the extent of any quantity not less than one-half the quantity generated, at prices not to exceed the prices charged to cities, towns and consumers in the United States at similar distances from the Falls of Niagara for equal amounts of power and for similar uses, and shall, whenever required by the Lieutenant-Governor-in Council, make a return of prices charged for such electricity or power, verified under oath by any chief officer of the Company, and if any question or dispute arises involv-

ing the non-supply or prices of electricity or power for consumption in Canada the High Court of Justice of Ontario shall have jurisdiction to hear and determine the same and enforce the facilities to be given or the prices to be charged.

34. All power developed within the limits of the Park under this agreement shall be in a form capable of transmission and use outside the Park, and shall not be used within the Park except such uses as may be convenient or necessary within the buildings of the Company for the purposes of its power development, and except such cases as may be hereafter agreed upon for railway, pumping, elevator, or other purposes within the Park. The Company may agree with the Niagara Falls Park and River Railway Company for the supply of electricity, pneumatic or other power to work the said railway, and with the Town of Niagara Falls, Ontario, and the Town of Niagara Falls South, Ontario, for the supply of power for their pumping station or stations within the Park, and may also supply electricity for any other persons within the Park.

35. If the Company should at any time or times after the completion of its plant and power house, or the first of April, 1906, whichever shall first happen, continuously neglect for the space of one year effectually to generate electricity or pneumatic power as hereby agreed by the Company, unless hindered by unavoidable accident, the Lieutenant-Governor-in-Council may then and from thenceforth declare this agreement, the liberties, licenses, powers and authorities thereby granted and every of them to be forfeited, and thenceforth the same shall cease and determine and be utterly void and of no effect whatever.

36. The rents hereby agreed to be paid are hereby declared to be the first and preferential charge upon the said works, and the Company shall not have power to create any lien, charge or encumbrance upon the said works or any of them by bond, debenture, mortgage or otherwise which would interfere with or prevent the Commissioners from procuring payment of the rent hereby reserved or any part thereof: and no simple contract creditor or other creditor of the Company shall have any claim against the said works or any part thereof in priority of the claim of the Commissioners for rent.

37. The said Company shall not amalgamate with any other corporation or company heretofore or hereafter incorporated by or under the laws of the Dominion of Canada or by or under authority of the Province of Ontario, or which shall be hereafter licensed by the said Commissioners to take and use the waters of the Niagara or Welland Rivers or both for the purpose of generation and transmission of electricity without the consent of the Lieutenant-Governor-in-Council to such amalgamation, nor shall they enter into any arrangement or agreement for that purpose with any such Company which may directly or indirectly have that effect, or which may or shall have the effect of keeping up the price or prices of said power, nor shall they enter into an agreement with any such Company for pooling the receipts of the said Company, or of any part thereof, with those of any other Company, nor which shall provide for or have the effect of establishing a common charge or schedule of charges for the use of said power or any part thereof.

38. This agreement shall have no force or effect until approved by the Lieutenant-Governor-in-Council.

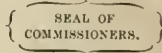
In witness whereof the Board of Commissioners, acting by and through their Chairman, duly authorized for all purposes hereof, by resolution of the Board, duly passed on the 11th day of April, 1900, has affixed its corporate seal and has signed, sealed and executed the present agreement.

And the Company, acting by and through its President and Secretary, duly authorized for all purposes hereof, by resolution of the Board of Directors of the

said Company, duly passed on the 9th day of April, 1900, has hereunto affixed its corporate seal under the hand of the President and Secretary.

Received from the Ontario Power Company of Niagara Falls the sum of thirty thousand dollars (\$30,000), being the first two years' rental in advance under the above agreement.

THE COMMISSIONERS OF THE QUEEN VICTORIA
NIAGARA FALLS PARK.

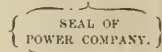


(Sgd.)

J. W. LANGMUIR,
Chairman.

THE ONTARIO POWER COMPANY OF

NIAGARA FALLS,



(Sgd.)

JOHN J. ALLBRIGHT,
President.

(Sgd.)

ROBERT C. BOARD,
Secretary.

The corporate seal of each of the corporations
affixed and the above signatures made and
delivery of this instrument being duly made
by the said signatories on behalf of their
respective corporations in my presence.

(Sgd.) JAMES WILSON.

REPORT

OF THE

COMMISSIONER OF PUBLIC WORKS

FOR THE

PROVINCE OF ONTARIO

FOR THE

YEAR ENDING 31ST DECEMBER,

1899.

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO.



TORONTO:

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1900.

REPORT
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COMMISSIONER OF PUBLIC WORKS
FOR THE
PROVINCE OF ONTARIO
FOR THE
YEAR ENDING 31ST DECEMBER,
1899.

To His Honour SIR OLIVER MOWAT, K.C.M.G.,

Lieutenant-Governor of the Province of Ontario, etc.

As required by the provisions of the statute in that behalf, I beg to submit the reports of the Departmental Architect, Engineer, and Accountant and Law Clerk for the year 1899.

The Architect's report gives details of the works connected with the maintenance of the Legislative and Departmental Buildings, and of the construction and completion of additions and the maintenance of the buildings of the several public Institutions and other Provincial buildings.

The Engineer's report contains details of the works at the several reserve dams; timber dams and slides and swing and fixed bridges crossing same; the blasting, dredging and improving channels of navigation, and clearing and dredging streams, etc.; and tabulated statement showing the mileage of completed railways, and the number of miles under construction.

The Accountant and Law Clerk's Statement No. 1 shows a total expenditure on Maintenance and Repairs Account for Government and Departmental Buildings, Institutions and Works for the year 1898; Statement No. 2 shows the total expenditure for Public Buildings and Works under capital account, for the year 1898; Statement No. 3 shows the total capital expenditure on Building and Works from 31st December, 1898, and Statement No 4 shows the several Contracts and Bonds entered into with Her Majesty during the year 1899.

Respectfully submitted,

F. R. LATCHFORD,

Commissioner.

DEPARTMENT OF PUBLIC WORKS. ONTARIO.

January, 1900.

REPORT OF THE ARCHITECT.

DEPARTMENT OF PUBLIC WORKS, ONTARIO.

Toronto, December 31st, 1899.

HON. F. R. LATCHFORD,

Commissioner of Public Works, Ontario :

SIR,—I have the honour to submit the following report upon the Construction and Maintenance of Public Buildings during the twelve months ended December 31st, 1899.

GOVERNMENT HOUSE.

Owing to the unsanitary condition of the residence through the escape of gas, the pipes being old and the joints leaking in many places, it was deemed expedient to substitute electric light for gas. Specifications were prepared and tenders called for the installation of electric light ; and the contract awarded to the Electrical Maintenance and Construction Company of Toronto, their tender being the lowest for the work. The contract has been carried out in a proper manner, under the superintendence of the inspector and in accordance with the underwriters' rules. Tenders were also called for electric fixtures, and the contract awarded to the lowest tender, that of Messrs. McDonald & Wilson, of this city.

Repairs have been made to the buildings, etc., and the ground kept in good order.

THE PARLIAMENT BUILDINGS.

Ordinary repairs have been made to the buildings when necessary, and furniture and fittings supplied as required to the different departments.

The roads, walks and gardens were kept in particularly good order, and reflected great credit on the superintendent of grounds and gardens.

OLD PARLIAMENT BUILDINGS.

Necessary repairs have been made to the offices of the Emigration Department and the house occupied by the caretaker in charge of the buildings.

ASYLUM FOR INSANE, TORONTO.

Repairs were made to the roof of the main building and to roofs of east and west cottages. The sewage from the Asylum, Central Prison and the Andrew Mercer Reformatory, which formerly discharged into the lake has been diverted, that of the two former to the King street sewer, and the latter to the Garrison Creek sewer, and all sewage from the Government institutions is now connected with the city system.

ASYLUM FOR INSANE, LONDON.

Tenders were called for slating the roof of the east wing of the north building, early in the season, and the contract awarded to Messrs. Stevely & Son, of London, their tender being the lowest. The work was done satisfactorily under the superintendence of the carpenter of the institution. The roof of the west wing which is in an equally irreparable condition was temporarily fixed to tide over the winter. An appropriation will be asked in the estimates in the coming year to slate this part of the roof, similar to the east wing. Repairs were also made to some portions of the roof of main building. Glass screens and doors have been placed in the corridors at the junction of the main and wing buildings to improve the light in passages.

ASYLUM FOR INSANE, HAMILTON.

The fitting up of the Gegenstrom spray system bathing apparatus in the bathrooms in basement, which was commenced last year, has been completed and is working satis-

factorily. The apparatus is also being constructed in two of the bathrooms on the ground floor, and will soon be completed. Considerable work had to be done in preparing and altering these rooms for the reception of the apparatus, the old floors being removed and new floors constructed with iron beams and brick arches covered with cement, and finished with tile, the walls being plastered with cement; the whole being made perfectly water tight and forming a complete bath. The work was done by the department with the assistance of asylum labour.

As the old ice house was in a dilapidated condition and beyond repair, an appropriation was granted in this year's estimates for the erection of a new one, which has been completed. The contract was awarded to Mr. Cheyne, of Hamilton, after tenders had been duly called for and his found to be the lowest.

In the early part of May the Medical Superintendent reported that the main sewer from the Institution leading down the Mountain to the city sewer had burst. On examination it was found the damage had been caused by a land slide which shifted and broke some of the sewer pipes. Men were employed by the department under a competent foreman, and the sewer permanently repaired. Some slight repairs were made to the buildings.

An addition has been built to the bursar's residence, the work being satisfactorily done by asylum labour.

ASYLUM FOR INSANE, KINGSTON.

Repairs have been made to a portion of the stone work in rear of the main building, the joints having opened through the action of the weather, being pointed with portland cement, but there is still a large surface of the walls and chimneys remaining which requires similar treatment.

Improvements have been made to the steam mains and boiler connections in the main building, the same having been enlarged by which it is expected a considerable saving will be made in the amount of coal consumed. The work was done by men employed by the department under the supervision of the departmental plumber.

Repairs have also been made to the roof of the main building, including eaves, flashings, etc. Also to the gas tank and well.

The gas works at this institution are rather a crude apparatus and the operating of same is anything but satisfactory, and if continued would have to be practically reconstructed and improved at a large expenditure, consequently it is proposed to instal electric light, which, no doubt, will greatly improve the lighting of the buildings and grounds.

ASYLUM FOR INSANE, BROCKVILLE.

Necessary repairs have been made to the buildings generally. The attic of the east wing of the main building has been completed, including day rooms, dining rooms and dormitories, giving ample accommodation for sixty patients. It is also fitted up with plumbing and heating appliances similiar to other floors. The work was done with the exception of the metallic ceilings, by men employed by the department in charge of a competent foreman. The metallic ceilings were constructed by Mr. R. Smart, of Brockville, his tender being the lowest. The work has been satisfactorily completed.

A small addition has also been built to the laundry for the iron heating furnace.

CENTRAL PRISON, TORONTO.

Plans and specifications were prepared by the department for a residence for the warden, which is located to the east of the main building. The work was commenced early in the summer, and the building is now nearly completed. The whole of the work, with the exception of the slating and wiring for electric lighting, has been done in a satisfactory manner by prison labour.

AGRICULTURAL COLLEGE, GUELPH.

Owing to an insufficient draught in the chimney of the boiler house, which caused a

waste in fuel, it was decided to construct a larger chimney with flue capacity sufficient, not only for present requirements, but for additional boilers which may be required should more buildings be erected. The contract was awarded to Mr. J. Rundell of Guelph after tenders were called for, his being the lowest. The work has been completed in a satisfactory manner under clerk of works, Mr. J. Wilson. The dimensions of the chimney are as follows: flue 5 ft. x 5 ft., height from ground 100 ft., width at base 10 ft., width at top 7 feet.

A large skylight has been constructed in the roof over the lecture room of the biological building, which has greatly improved the lighting of the room.

NORMAL AND MODEL SCHOOLS, TORONTO.

Granolithic walks have been laid from Church and Victoria streets to the boys' and girls' entrances of the Model School, and a connecting walk laid on the east side of the Education Department building. The contract was awarded to the lowest tenderers, Messrs. McKnight & Co. The work has been well done under the superintendence of the department.

Repairs to the buildings have been attended to.

NORMAL AND MODEL SCHOOLS, OTTAWA.

Repairs have been made to the buildings, yards and fences where necessary. The tool house, ash house, etc., on the south side were removed, and a gravel road constructed, leading from Lisgar street to boiler house and side entrance of the Model School, which has very much improved the appearance of the grounds.

The partition between the drawing class room and the room adjoining in the east end of the Model School on the ground floor has been removed, as the former was found to be too small for the requirements of the class, and the space converted into one large room, which has been papered and painted.

The kindergarden room on the opposite side of the corridor has also been papered and painted in an artistic manner. The apartment to the left of the main entrance hall in the Normal School, formerly occupied by the drawing master, has been converted into a reception room, the walls being papered and the ceiling tinted. The walls of the main entrance hall have also been papered.

Repairs were made to the boilers, steam heating and plumbing apparatus; and other repairs to the buildings attended to.

NORMAL SCHOOL, LONDON.

The work was resumed on this building in the beginning of March, and rapid progress made until the foundations were built and the ground floor joists laid. From the ground line to the level of top of joists is built of brown stone. Above this portion the stone work is built of grey stone. Owing to the difficulty in obtaining the quality of the latter called for in the specifications, considerable delay in the construction of the building was caused thereby.

Tenders were called for the steam heating and plumbing, and the contract awarded to the lowest tender, that of Mr. J. Purdom, of London.

Tenders were also called for the wiring for electric lighting, and the contract awarded to the Rogers Electric Co. of London, their tender being the lowest. Steam heat has been in the building for some time and both of these contracts are nearing completion.

The drains have been laid and connected with the city sewers; and the whole of the contracts are rapidly approaching completion so that the building will be in a sufficiently advanced state to permit of it being opened for classes not later than February 1st next.

SCHOOL OF PRACTICAL SCIENCE, TORONTO.

Additional rooms have been fitted up in the centre attic for photographic purposes, being lighted from the roof by a large skylight. The work was done under contract by Messrs. Windsor & Woodley, their tender being the lowest.

A room in the basement adjoining the Electrical Laboratory, and formerly occupied

as a cloak room, has been fitted up as an annex to the former ; the work in this case being done by men employed by the Department.

The assembly hall which was dimly lighted by gas has been fitted with electric lights, and the results have been most satisfactory.

Repairs were made to the roofs and other portions of the building when found to be necessary.

OSGOODE HALL, TORONTO.

The covering of the roof over the judges' apartments in rear of the west side of the building, which was beyond repair, has been removed and the roof recovered with galvanized iron, the work being properly done by Mr. J. J. Powers, whose tender was the lowest.

Two of the steam boilers were rebricked and fitted with improved grate bars.

Repairs throughout the buildings generally have been attended to, including repairs to furniture.

Furniture, etc., has been supplied as required.

COURT HOUSES, GAOLS AND LOCK-UPS.

A lock-up has been erected at Thessalon adjoining the court house, and a small addition has been built to the gaol at Fort William for a kitchen for the gaoler.

Plans and specifications were prepared and tenders called for a court house to be erected in Bracebridge, and the contract awarded to the lowest tender—that of Mr. J. R. Eaton of Orillia. Work was commenced in July, and satisfactory progress has been made. The roof is finished and the building enclosed and will be completed early in the season. The building is two storeys in height—the ground floor being composed of offices for the sheriff, judge, and legal officers ; the upper floor consists of a court room 27x44 feet, with petit jury room and a barristers' room adjoining. The basement is so arranged that a portion of it can be fitted up with cells, which I understand will be required in the near future.

Repairs have been made to the court house and gaol at North Bay. An arrangement was made with the town council to lower the street drain sufficiently deep to properly carry off the drainage from the court house and gaol. The drain has been lowered, and the drains from the court house and gaol connected therewith, the latter work being done by men in the employment of the Department.

As the yard of the gaol at Mattawa was found to be too small it was decided to enlarge the same, which has also been done by men employed by the Department.

A small house has been erected for the gaoler at Fort Francis, and a lock-up at Mines Centre, the work being satisfactorily done by men employed by the Department under foreman Mr. J. J. McLaren.

A hot water heating apparatus has been put in the court house and gaol at Rat Portage ; the work was done by Messrs. J. J. Wells & Co. of Rat Portage, whose tender was the lowest.

Repairs to the buildings generally throughout the districts have been attended to and furniture supplied where necessary.

VICTORIA COLLEGE, COBOURG.

Some repairs were made to the brick work of Farrady hall, which had been damaged by the weather ; the work was done by men employed by the Department.

BOILER INSPECTIONS.

The boilers of the different institutions throughout the Province have been twice inspected during the year by the Departmental Inspector of Boilers, who has duly reported thereon, and the necessary repairs have been attended to as required.

I have the honor to be, Sir,

Your obedient servant,

F. R. HEAKES,

Architect.

REPORT OF THE ENGINEER.

DEPARTMENT OF PUBLIC WORKS, ONTARIO.

TORONTO, December 30th, 1899.

HON. F. R. LATCHFORD,

Commissioner of Public Works, Ontario.

Sir,—I have the honour to submit the following report on the construction and maintenance of Public Works, also respecting the extension of railways throughout the Province during the year 1899.

GULL AND BURNT RIVER WORKS.

The works which have been attended to out of this appropriation during the present year, are as follows:

A dam has been built at the outlet of Big Bob Lake in the Township of Lutterworth, County of Haliburton, 98 feet in length, 15 feet in width, and 13 feet in height, with a slide opening in same 10 feet in width and 9 feet in depth. The cribwork is constructed of 10 x 12 inch hemlock timber fastened together with $\frac{3}{4}$ inch iron drift bolts; the face of the structure being sheathed with 2 inch planking, with a course of 1 inch lumber on top; the joints between the two being well broken, and the whole securely fastened with $\frac{3}{8}$ inch wrought iron spikes and cut nails. The dam is supplied with a stop-log platform 24 feet in length and 12 feet in width, constructed with 12 x 12 inch stringers and 3 inch planking, and the necessary stop logs and windlasses and chains have been provided. An embankment 24 feet in length and 15 feet in width at the base, has also been formed across a ravine situated a short distance from the dam to prevent the water running to waste through the natural channel.

The dam and slide at the outlet of Little Bob Lake situated on lot No. 13, in the XIth Concession of the Township of Lutterworth, has also been entirely reconstructed; the old structure built in 1881 having become in a decayed and unsafe condition. The dam is 113 feet in length, 20 feet in width and 12 feet in height, constructed with 10 x 12 inch square hemlock timber, fastened with three-quarter square iron drift bolts, the cribwork being compactly filled with stone.

The slide 104 feet in length and 3 feet 6 inches in width at the bottom, with sides built battering $7\frac{1}{2}$ inches to the foot, is constructed with three 12x12 inch square hemlock stringers running the entire length. The floor sills are of 8 x 10 inch hemlock placed 4 feet apart from centres, and the posts and braces are 6 x 6 inches square, the flooring being of birch 6 inches in thickness, and the sides which are from 4 to 6 feet in height are formed of 3 inch pine planking.

The wing dams at the head of the Racketty Creek slide, which is situated a short distance below the outlet of Little Bob Lake, have also been rebuilt with 10 x 12 inch hemlock timber, the one on the westerly side being 35 feet in length, 8 feet in width and 5 feet in height, and on the easterly side 54 feet in length, and a similar width and height; the cribwork of both being filled with stone.

The Racketty Creek slide has been repaired at the upper end by rebuilding the northerly side for a length of 31 feet and to a height of 4 feet with 10 x 12 inch hemlock timber; and one of the piers upon which the slide rests 10 x 12 feet square and 6 feet in height, has also been rebuilt and repairs have been made to the flooring at the lower end of the structure.

The dams at the outlet of Mud Lake in the Township of Dysart which reserve the waters of Mud, Spruce and Drag Lakes, the superficial area of which is about 2,100 acres, have been rebuilt; the old structures erected in 1882 having become in a decayed and dangerous condition.

The dams are situated about two and a half miles from the village of Haliburton, at the head of a long rapid, the river at this point being divided into two channels by an island.

The dam across the northerly channel is eighty-one feet in length, fifteen feet in width, and averages 12 feet 6 inches in height, with a slide opening in same 6 feet 6 inches in width.

The dam across the southerly channel is 109 feet in length, 15 feet in width, and about 12 feet 6 inches in height. It is provided with two openings for the escape of flood-water, one being 12 feet in width by 9 feet in depth, and the other 19 feet in width and 2 feet in depth. The openings in both dams are supplied with platform stop-logs and windlasses and chains so as to enable the water to be regulated as desirable.

The stop-log dam across the northerly outlet of Oblong Lake, situated on lot No. 8 in the VIth Concession of the Township of Harbarn, and which reserves the waters of Oblong and Haliburton Lakes, the superficial area of which is about 2,700, acres has been entirely rebuilt.

The dam is 94 feet in length, 20 feet in width, and 17 feet in height, with a stop-log opening in same 16 feet in width and 10 feet in depth, and is provided with a slide 46 feet in length and 16 feet in width, and the necessary platform stoplogs and windlasses, etc., to enable the flow of the water to be regulated. The structure is built of hemlock timber, fastened together with three-quarter inch square iron drift bolts; the cribwork being compactly filled with stone.

A substantial embankment 82 feet in length and 9 feet in height has also been formed across the southerly outlet of the lake, immediately above the old dam, which does away with the necessity of again rebuilding that structure.

STAR LAKE IMPROVEMENT.

An appropriation of \$400.00 was granted last session to enable such improvement to be made at the outlet of this Lake, in the Township of Christie, as would materially lessen or do away with the damage sustained in the locality through the flooding of low-lying lands and highways during the seasons of high water, and the following works have been attended to.

The permission of the Parry Sound River Improvement Company to make an opening in the dam belonging to them at the outlet of the lake having been obtained, operations were commenced during the month of October, and a channel 40 feet in length, 14 feet in width, and an average depth of about three feet was excavated through the rocky shoal upon which the dam is situated, after which two stop-log piers 20 feet in length, 6 feet in width and 6 feet in height were constructed, and the necessary platform stop-logs and windlasses and chains provided, so as to enable the height of the water to be regulated, the work being completed about the middle of November.

MAINTENANCE OF LOCKS, DAMS, BRIDGES, ETC.

The repairs and improvements attended to out of this appropriation during the present year have been as follows:—

DAM AT PORT CARLING, ETC.

The dam across the Indian River, at Port Carling, which was erected in 1881, so as to enable the water of Lakes Rosseau and Joseph to be reserved for navigation and other purposes, has been rebuilt from low water up a height of five feet. The dam is about 220 feet in length and 12 feet in width, with six stop-log openings in it 20 feet in width each, and is supplied with a stop-log platform 184 feet in length and 12 feet in width, and the necessary winches, chains, etc., for raising and lowering the stop-logs.

Repairs have been made to the flooring of the fixed bridge with 3-inch hemlock planking, and new handrailings have been provided at each end 38 and 24 feet in length respectively.

The swing-bridge has been provided with one new needle beam, and a new piece in the lower chord 22 feet in length of 10x12-inch hemlock timber, and repairs have also been made to the swinging gear.

The pier at the northerly end of the dock below the lock which was shifted during the high water last spring has been replaced in position, and the cribwork on the westerly side at the upper end of the chamber has been provided with a new stringer of 10x12-inch timber, and replanked with 3-inch hemlock for a distance of 30 feet.

During the month of June considerable difficulty was experienced in working the lower gates of the lock, and upon examination being made by a D-partmental diver, it was ascertained that some partly burnt hardwood had washed down and lodged against the lower mitre sill, which obstructions were removed and the difficulty done away with.

DAM AT BALA, ETC.

A dam has been constructed across the southerly outlet of Lake Muskoka, at Bala, to replace the old one erected in 1878, which through decay had become in a leaky and unsafe condition.

The new structure is located immediately below the site occupied by the old one, and has four openings in it 28 feet in width each, and one 23 feet, three of them being 9 feet in depth, and the others 7 and 5 feet respectively.

The piers between the openings, 8 feet in width and 17 feet in length with cutwaters on the upper ends making the total length 22 feet, are constructed of hemlock timber securely fastened together with $\frac{3}{4}$ -inch square iron drift bolts, and the cribwork is compactly filled with stone. The stop-log platform 187 feet in length and 12 feet in width, is constructed with 10x12 inch corbels and stringers, the flooring being of 3-inch pine planking; and the necessary track and winches, etc., required for handling the stop-logs have been provided.

In the carrying out of the work, a shoal of rock which seriously interfered with the passage of the water through one of the openings in the old dam was blasted and removed, which enlargement of outlet it is expected will materially assist in keeping down the lake level and lessening the damage and inconvenience heretofore experienced during time of freshet.

The top course of timber on the three piers which support the guide boom above the dam, having been torn off during the freshet last spring, owing to the boom being carried over them, has been replaced and the boom again put in proper position, and the roadway bridge and approaches thereto, the total length of which is 177 feet, has been provided with new flooring of 3-inch hemlock planking and the stonework of the piers and retaining walls repaired and pointed up with Portland cement mortar.

The sheeting on the cutwater of the main pier of the bridge has also been renewed with pine planking and repairs made to the stop-logs belonging to the dam across the northerly outlet of the lake.

PORT SANDFIELD SWING BRIDGE, ETC.

The cribbing on the westerly side of the channel has been provided with a new course of 10x12 inch hemlock timber for a length of 183 feet on the face and 80 feet on the back, and the pier at the northwesterly end 29 feet in length and 10 feet in width has been repaired and covered with 3 inch hemlock planking.

A quantity of filling which had been washed out of the cribwork on both sides of the channel during the high water last spring has also been replaced and the swing bridge provided with a considerable quantity of new flooring.

MAGNETAWAN SWING BRIDGE, ETC.

The swing bridge at this point 100 feet in length and 12 feet 6 inches in width, has been provided with a new floor of 3 inch hemlock planking, and the rest pier at the southerly end 20 feet in length at the back, 17 at the front, and 8 feet in width, has been rebuilt 6 feet in height with 12x12 inch hemlock timber and new posts and handrails have been provided for a length of 27 feet on the southerly approach to the bridge.

MARY'S & FAIRY LAKES LOCK, ETC,

In the latter part of September, such serious leakage occurred around the lower gates of this lock that it was necessary to close it, and upon examination being made by a diver, it was ascertained that the mitre sill had been moved from its place and two pieces of planking torn off the platform, the damage having in all probability been caused by steamers striking it. Repairs were made which enabled the entire interference with navigation to be limited to only a few days, but steps will require to be taken in the early part of the coming year to properly replace and secure the sill in its former position.

The highway bridge across the Muskoka River, situated a short distance above the lock has been provided with two cross sills and nearly all new floor stringers, and repairs have been made in several places to the planking; and the Peninsula Creek Canal bridge has also been supplied with new floor stringers, and a new needle beam, and replanked with 3 inch hemlock planking for its entire length of 184 feet, the bents in the approaches being also provided with two new posts, three caps and two sills.

Repairs have also been made to the cribwork along the banks of the canal in several places where it had sustained damage during the season of high water.

WORKS AT ELLIOTT'S FALLS, GULL RIVER.

The guide pier situated immediately above the lower slide and on the easterly bank of the river 60 feet in length, 10 feet in width and 9 feet in height, has been rebuilt, the old structure having become in a decayed and worn out condition. The cribwork is formed with 10x12 inch sawn hemlock timber, fastened together with $\frac{3}{4}$ inch iron drift bolts; the foundation timbers being securely rock bolted, and the entire structure compactly filled with stone.

The main dam has been replanked both in front and back for a length of 53 feet with 3 inch pine planking and well gravelled to make it watertight; and the pier at the westerly end 30 feet in length and 13 feet in width has been rebuilt two feet in height with 10 x 12 inch square timber, and the top covered with 3 inch planking. The stop-log piers at the slide opening in the easterly end of the dam, 20 feet in length and 10 feet in width have been taken down and rebuilt 6 feet in height, and a new stop-log platform 34 feet in length and 12 feet in width with the necessary windlasses etc. required for handling the logs have been provided.

A portion of the guide boom above the dam 170 feet in length and 32 inches in width, which owing to the formation of a jam of logs during the high water last spring, was carried away, has also been replaced.

OTTER LAKE DAM.

The slide opening in this dam, which is situated in the Township of Monmouth, has been provided with new hardwood flooring 4 inches in thickness, which is fastened with 8 inch wrought iron spikes, and the dam has been supplied with five new stop-logs and well gravelled to make it watertight. Repairs have also been made in several places to the planking in the side dam, and some gravelling done, and the stop-logs in the dam on Otter Creek, have also been attended to.

The dam at the outlet of Grace Lake has been supplied with one new stop-log and otherwise repaired; and the Pine Lake dam, situated in the village of Gooderham, has been provided with two new windlasses, and some gravelling done to the dam at the outlet of Horse Shoe Lake.

BALSAM RIVER LOCK.

One of the balance beams on this lock, which was broken was repaired, and rendered fit for service during the past season of navigation; but provision will require to be made to furnish all the gates with new beams in the early part of the coming year, the old ones being in a decayed and unreliable condition.

LINDSAY LOCK, SWING BRIDGES, ETC.

The chamber of the lock and gate recesses were cleared out by a diver in the early part of the season, and a large amount of material removed which had seriously interfered with the working of the lock, and a quantity of the concrete around the mitre sills and walls of the chamber, which owing to having become loose allowed leakage to take place, was removed and replaced with new material.

The Swing Bridge adjoining the lock on Lindsay Street has been supplied with new floor stringers throughout, and eleven new needle beams, also with two new corbels and ballast box, and entire new floor planking on the roadway portion, also on the footwalk on the easterly side.

The Wellington Street bridge has been provided with a new centre pier 17 feet square and 11 feet in height, constructed with 12 x 12 inch square pine timber fastened with $\frac{3}{4}$ inch square iron drift bolts and the crib work filled with stone. The turntable has also been supplied with seven wheels, and the balance of the swinging gear attended to and put in good working order, and a new double bent constructed of 12 x 12 inch square timber has been provided at the westerly end to support the approach and form a rest for the bridge. The flooring has also been repaired with 2 inch hemlock planking for the entire length of the structure, and to a width of 8 feet, the new planking being laid on top and spiked to the old flooring which had become in a worn and dangerous condition, where it had been subjected to the bulk of the traffic. During the time the old centre pier was being removed and the new one under construction, the bridge was supported on temporary bents in a way which rendered it unnecessary to close the structure to traffic; consequently the public suffered no inconvenience while the improvements were being carried out.

The piers which support the platform on the westerly side of the swing bridge over the Scugog River a short distance south of Lindsay, have been rebuilt two feet in height, and the platform 100 feet in length and 6 feet in width with an extension to the shore 44 feet in length and 12 feet in width has been entirely reconstructed with double 12 x 12 inch stringers and 3 inch planking. The platform on the easterly side 40 feet in length has been rebuilt in a similar manner, the width being 6 feet, for a distance of 28 feet, and double that for the remainder.

The shore pier at the northerly end of the bridge 14 x 16 feet square has also been rebuilt from low water up a height of 7 feet, with 12 x 12 inch square timber, and two new wheels have been supplied for the turntable.

The following are the different Lockmasters returns of lockages made during the year:

1. Magnetawan Lock: 578 steamers, 30 small boats, 91 scows and 18 rafts or cribs of timber.
2. Mary's and Fairy Lakes Lock: 355 steamers, 71 small boats, 116 scows and 108 rafts or cribs of timber.
3. Port Carling Lock: 2392 steamers, 1151 small boats, 700 scows and 473 rafts or cribs of timber.
4. Young's Point Lock: 1020 steamers, 340 small boats, 107 scows and 113 rafts or cribs of timber.
5. Lindsay Lock: 193 steamers, 39 small boats, 174 scows and 32 rafts or cribs of timber.
6. Balsam River Lock: 323 steamers, 104 small boats, 37 scows, 47 rafts or cribs of timber, 79,100 logs and 607 pieces boom timber.

UNION CREEK IMPROVEMENT.

The work attended to out of the appropriation granted last session for expenditure on the improvement of this creek, which extends through the Township of Galway, consisted of the removal of boulders, fallen trees, sunken timber and other debris from the bed of the stream, and the cutting and removal of brush along the banks, which impeded the flow of the water. The portions of the stream upon which these works have been attended to are on Lots 3, 4, 6, 7 and 8, in the 13th Concession, and from Lot 20 in the 14th Concession to Lot 15 in the 15th Concession; also on the west branch on Lots 3 and 4 in the 12th Concession, and on the east branch on Lots 7 and 8 in the 8th and 9th

Concessions. The work was commenced in the latter part of September and completed about the 20th of October.

OTONABEE RIVER.

YOUNG'S POINT LOCK, ETC.

The improvements attended to during the present year in connection with these works have been as follows:

The construction of the breast wall along the westerly side of the canal above the lock, which, as previously reported, was well advanced at the close of 1898, was continued in the early part of the present year, and the work completed before the opening of navigation.

The pier immediately below the lock and on the westerly side of the channel has been rebuilt from low water up for a length of 50 feet, 30 of which is 5 feet in height and the remainder, which adjoins the lock wall, 12 feet, the whole being 10 feet in width.

The cribbing is constructed of 10x12 inch hemlock and cedar timber, fastened together with $\frac{3}{4}$ -inch iron drift bolts 22 inches in length, the whole being compactly filled with stone and planked over with 3 inch hemlock.

The three piers which support the guide boom at the lower entrance to the lock have each been provided with a course of 10x12 inch timber on top, but these piers will require to be reconstructed from low water up, and the shore pier entirely rebuilt during the coming year.

Repairs have also been made to one of the upper lock gates, the work being done by a diver, and a quantity of gravel and other debris which had accumulated around the stop-log piers at the head of the canal above the lock to such an extent as to interfere with the water being expeditiously shut off in case of accident has been removed and the channel immediately above deepened.

PAYNE RIVER.

The improvement of this stream, which extends through the Townships of Finch and Roxborough, in the County of Stormont, and which was commenced during the month of July, 1898, was continued during the present year until the month of September, when the work was completed, the channel having been improved from a point in Lot No. 21 in the 2nd Concession of Finch to a point near the Village of Avonmore in the Township of Roxborough, a distance of about five miles.

The work, which consisted of the removal of clay, gravel, boulders and hard-pan, also a considerable quantity of solid rock, was carried out by the municipal authorities, and upon the Department being notified of its completion examination was made, and as it was found to have been satisfactorily performed and properly certified vouchers of the expenditure furnished, the appropriation of \$4,000 revoted last session to assist in carrying it out was paid.

The improvement made will without doubt materially relieve the low lying lands and highways in the locality from the flooding during time of freshet, which they have in the past been subjected to, and it will also enable considerable areas of useless lands to be unwatered and rendered fit for cultivation by the construction of drains, for which a proper outlet could not formerly be obtained.

SQUAW RIVER.

The work attended to out of this appropriation consisted of the reconstruction of a dam situated on Lot 17 in the 12th Concession of the Township of Harvey, and about half a mile from the outlet of the stream into Big Ball Lake.

The new structure is 115 feet in length, 13 feet in width and 10 feet in height, with a slide opening in same 10 feet in width which is floored with birch planking 6 inches in thickness. The stop-log platform 24 feet in length and 12 feet in width is constructed with 12x12 inch timber, covered with 3 inch planking, and the necessary windlasses and chains for raising and lowering the logs have been provided. The construction of the dam is open cribwork formed of 10x12 inch hemlock timber, which is fastened together

with three-quarter inch square iron drift bolts, the face of the structure being sheeted with two inch planking, with a course of one inch lumber on top, both being securely fastened with three eighth inch iron spikes and cut nails, and the cribwork is compactly filled with stone.

The work was commenced during the latter part of February and completed in the early part of April.

GEORGIAN BAY.

An appropriation of \$250.00 was granted in the Supplementary Estimates last session, for expenditure on repairs to the cribwork which was erected by the Department in 1888, on what is known as the "Inner Channel," at a narrows situated about seven miles southerly from Parry Sound, which work had been considerably damaged in consequence of the steamers being swept against it by the strong current which is almost continually running either up or down these narrows.

The work was attended to during the latter part of July and the early part of August, the lower end of the cribbing being rebuilt a height of about four feet for a length of 126 feet, with 12x12 inch square timber.

The balance of the structure is in a fair state of repair, and it is expected will serve the intended purpose for some years to come.

EXTENSION OF RAILWAYS IN 1899.

The works of this description which have been under way during the present year are as far as could be ascertained as follows :

ONTARIO AND RAINY RIVER RAILWAY.

As previously reported the construction of this line was commenced on the 1st of August, 1898, at Stanley Station, on the Port Arthur, Duluth and Western Railway, situated about 20 miles westerly from Port Arthur, and at the close of that year the grading had been completed for a distance of about 15 miles. Operations have been continued during the present year, and I understand that the grading is now completed for about 50 miles and that the rails are laid and the ballasting completed on about 20 miles and it is expected that 40 miles will be completed and opened for traffic in the early part of the coming year.

CENTRAL ONTARIO RAILWAY.

Construction work has been in progress since the month of August last on an extension of this railway, from a point about $2\frac{1}{2}$ miles south of Ormsby to the Village of Bancroft, a distance of 21 miles, and I understand that 16 miles have been graded and the track laid and roadbed ballasted for two miles, and that it is expected the entire extension will be completed and opened for traffic to Bancroft about the month of July next.

ALGOMA CENTRAL RAILWAY.

This line is intended to extend from Sault Ste. Marie northerly to a point on or near the Michipicoten River, thence on to the Canadian Pacific Railway, with a branch to Michipicoten Harbour on Lake Superior.

Construction was commenced on the branch in the month of July last, and I understand the line is now completed from the Harbour easterly to the Helen Hematite Mines—a distance of 12 miles—and that iron ore will be hauled over it as soon as navigation opens in the coming spring. Construction work will, I am informed, be vigorously prosecuted during 1900, and it is expected the Michipicoten Branch 40 miles in length and 50 miles of the main line will be completed before the close of the year.

The following revised statement to the close of 1899 gives in detail the mileage of each railway in Ontario, distinguishing between those constructed prior to and since Confederation :

REVISED STATEMENT.

No.	Name of railway.	Terminal points.		Completed prior to Confederation	Completed since Confederation	At present under construction.	Total length in operation of each rail-way or system of railways in miles.
		From.	To.	Length in miles.	Length in miles.	Length in miles.	
1	Grand Trunk Railway, Main Line.....	Eastern Province Boundary	Point Edward	457			
2	do do Buffalo & Lake Huron Branch.	Fort Erie	Goderich	158			
3	do do London Branch.....	St. Mary's	London	23			
4	do do Galt & Doon Branch.....	Galt	Berlin	7	4.5		
5	do do Waterloo Junction Railway...	Waterloo	Elmira		10.25		
6	do do Toronto & Nipissing Branch...	Toronto	Cobocouk		88		
7	do do Midland Railway, Main Line.	Toronto	Midland City	65	54.53		
8	do do Peterboro' Branch.....	Millbrook	Lakefield	13	9		
9	do do Lake Simcoe Junction.....	Stouffville	Jackson's Point		26.5		
10	do do Whitby, Port Perry & Lindsay	Whitby	Lindsay		46		
11	do do Victoria Railway.....	Lindsay	Haiburton		55.81		
12	do do Grand Junction Railway.....	Belleville	Peterborough		64.65		
13	do do Belleville & North Hastings ..	Grand Junction Rail-way					
14	do do Toronto & Ottawa.....	Madoc	Madoc		22		
15	do do Manilla Link.....	Wick	Bridgewater		9		
16	do do do Onenec Link.....	Onenec	Manilla		6.5		
17	do do Port Dover & Lake Huron ..	Port Dover	Peterborough		14		
18	do do South Norfolk Railway.....	Simcoe	Stratford		63		
19	do do Chemong Branch.....	Peterborough	Port Rowan		17		
20	do do Stratford & Huron.....	Stratford	Chemong Lake		9		
21	do do Owen Sound Extension.....	Parkhead	Warton		106.27		
22	do do Georgian Bay & Wellington ..	Palmerston	Owen Sound		12.40		
23	do do Main Line.....	Suspension Bridge	Durham		26		
24	do do Toronto & Hamilton Branch...	Toronto	Windor	229			
25	do do Loop Line Division.....	Glencoe	Fort Erie	39.5			
26	do do Kingscourt & Glencoe Link...	Kingscourt	Glencoe		145		
27	do do Sarnia Branch.....	Konoka	Sarnia	51	20.60		
28	do do Petrolia Branch.....	Wyoming	Petrolia	7			
29	do do Brantford Branch.....	Harrisburg	Brantford	8			
30	do do Brantford & Norfolk.....	Brantford	Tilsenburg		35.88		
31	do do Wellington, Grey & Bruce.....	Harrisburg	Southampton	27	102		
32	do do do S. Extension.....	Palmerston	Kincardine		66		
33	do do London, Huron & Bruce.....	Hyde Park Junction.	Wingham		69.75		

34	Grand Trunk Railway } London & Port Stanley	London	Port Stanley	25	.....	.....	.....
35	do } Great Western Div.	Port Colborne	Port Dalhousie	25	.....	.....	.....
36	Northern Railway, Collingwood Line	Toronto	Meaford	94	21	.....	.....
37	do Muskoka Branch	Barrie	Gravenhurst . . . . .	.....	63	.....	.....
38	do do Hamilton & Northwestern Main Line	Port Dover	Allandale . . . . .	.....	135.3	.....	.....
39	do do do Collingwood Branch	Clarksville	Collingwood . . . . .	.....	40	.....	.....
40	do North Simcoe Junction	Colwell	Penetanguishene . . . . .	.....	33.34	.....	.....
41	Northern & Pacific Junction Railway	Gravenhurst	La Vause . . . . .	.....	111.5	.....	.....
42	Toronto Belt Line Railway, Easterly Section	Don Station, G.T.R.	Junction with Northern Railway . . . . .	.....	8 50	.....	.....
43	do do Western Section	Carleton on G.T.R.	Swansea . . . . .	.....	4 33	.....	2719.11
44	Canadian Pacific Railway, Main Line	Ottawa	Western Province Boundary	57	1144	.....	.....
45	do do do	Ottawa	Eastern Province Boundary . . . . .	.....	66.40	.....	.....
46	do do Algona Branch	Sudbury Junction	Sault Ste. Marie . . . . .	.....	180 25	.....	.....
47	do do Brockville & Ottawa Railway	Brockville	Carleton Place	46	.....	.....	.....
48	do do St. Lawrence & Ottawa Ry. and Chaudiere Branch	Prescott	Ottawa	59.5	.....	.....	.....
49	do do Ontario & Quebec Railway	Toronto Junction	Eastern Province Boundary	12	281.25	.....	.....
50	do do do Don Branch	Main Line	Toronto . . . . .	.....	5	.....	.....
51	do do do Detroit Extension	London	Windsor . . . . .	.....	112 50	.....	.....
52	do do do Credit Valley Ry., Main Line	Toronto	St. Thomas . . . . .	.....	119 13	.....	.....
53	do do do Orangeville Branch	Streetsville	Flora and Orangeville . . . . .	.....	62.83	.....	.....
54	do do do Guelph Branch	Campbellville	Guelph . . . . .	.....	15	.....	.....
55	do do do Toronto, Grey & Bruce, Main Line	Toronto	Owen Sound . . . . .	.....	122	.....	.....
56	do do do do Teeswater Branch	Orangeville	Teeswater . . . . .	.....	73	.....	.....
57	do do do do do Wingham Branch	Glenora	Wingham . . . . .	.....	4.75	.....	.....
58	do do do do do West Ontario Pacific Railway	Woodstock	London . . . . .	.....	27	.....	.....
59	do do do do do Atlantic & North-West Railway	Renfrew	Eganville . . . . .	.....	19.25	.....	2406.86
60	Michigan Central Railway, formerly Canada Southern Main Line	Windsor	Suspension Bridge . . . . .	.....	226 8	.....	.....
61	do do do St. Clair Branch	St. Clair Junction	Courtright . . . . .	.....	62.2	.....	.....
62	do do do Amherstburg Branch	Amherstburg	Essex Centre . . . . .	.....	15.7	.....	.....
63	do do do Oil Springs	Oil City Junction	Eddy s . . . . .	.....	5.2	.....	.....
64	do do do Petrolia	Petrolia Junction	Petrolia . . . . .	.....	4 9	.....	.....
65	do do do Leamington & St. Clair Branch	Comber	Leamington . . . . .	.....	15.9	.....	.....
66	do do do do Fort Erie Branch	Welland Junction	Fort Erie . . . . .	.....	17.4	.....	.....
67	do do do do do Niagara	Fort Erie	Niagara	30	.....	.....	378.10
68	do do do do do Sound Colonization Railway	Scotia	Depot Bay . . . . .	.....	51.20	.....	.....
69	Ottawa, Arnprior & Parry Sound Railway	Ottawa	Scotia . . . . .	.....	212 60	.....	263.80
70	Canada Atlantic Railway	Ottawa	Eastern Province Boundary . . . . .	.....	68.08	.....	.....
71	Central Counties Railway	Glen Robertson	Boundary . . . . .	.....	21	.....	.....
72	do do do	South Indian	Hawkesbury . . . . .	.....	17	.....	106 08
73	Cobourg, Peterborough & Marmora Ry., Marmora Line	Cobourg	Rockland . . . . .	.....	14.5	.....	14 50
74	Kingston & Pembroke Railway	Kingston	Harwood . . . . .	.....	103	.....	103 00
75	Prince Edward County Railway	Pickton	Renfrew . . . . .	.....	32.44	.....	32.44
76	Central Ontario Railway	Trenton at G.T.R.	Trenton and G.T.R. . . . .	.....	74	.....	21

REVISED STATEMENT.—Continued.

No.	Name of railway.	Terminal points.		Completed prior to Confederation	Completed since Confederation	At present under construction.	Total length in operation of each railway in miles.
		From.	To.				
77	Ontario, Belmont & Northern Railway.....	Central Ontario Ry.	Belmont Mine .....	.....	.....	.....	83.57
78	Erie & Huron Railway	Rondeau	Sarnia .....	.....	9.57	.....	70.47
79	Napanee, Tamworth & Quebec Railway	Napanee	Tweed .....	.....	50	.....	57.00
80	do Harrowsmith Branch	Yarker	Harrowsmith .....	.....	7	.....	3.50
81	Bay of Quinte Railway.....	Deseronto	Grand Trunk Railway .....	.....	3.5	.....	5.00
82	Nosbonsing & Nipissing Railway.....	Lake Nipissing (S. E. Bay)	Lake Nosbonsing .....	.....	5	.....	45.00
83	Irondale, Bancroft & Ottawa Railway.....	Kinnoult	Bancroft .....	.....	45	8	45.00
84	Brockville, Westport & Sault Ste. Marie.....	Brockville	Westport .....	.....	45	.....	12.50
85	St. Catharines & Niagara Central Railway	Niagara Falls	St. Catharines .....	.....	12.5	.....	84.00
86	Lake Erie & Detroit River Railway	Walkerville	Ridgeway .....	.....	84	.....	85.54
87	Port Arthur, Duluth & Western Railway	Port Arthur	Gun Flint Lake .....	.....	85.54	.....	80.50
88	Toronto, Hamilton & Buffalo Railway	Waterford	Brantford .....	.....	18	.....	18.58
89	do do	Brantford	Welland .....	.....	62.5	.....	55.00
90	Tilsonburg, Lake Erie & Pacific Railway.....	Tilsonburg	Port Burwell .....	.....	18.58	.....	21.50
91	Ottawa & New York Railway	Ottawa	Cornwall .....	.....	55.00	.....	.....
92	Pembroke Southern Railway.....	Pembroke	Golden Lake .....	.....	21.50	.....	.....
93	Ontario & Rainy River Railway.....	Stanley on P. A. D. & W. Ry	Western Province Boundary .....	.....	.....	280	.....
94	Algoma Central Railway.....	Sault Ste. Marie.....	Michipicoten River .....	.....	.....	136	.....
95	do Michipicoten Branch	Michipicoten Harbour	Main Line of C.P.R. ....	.....	12	28	12,
96	.....	.....	.....	1,447.50	5,255.55	473	6,703.05

From the details given it will be seen that although construction work has been in progress on three lines of railway during 1899 the only distance completed ready to be opened for traffic is the twelve miles on the Michipicoten branch of the Algoma Central Railway which line was commenced during the year.

I have the honour to remain, sir,

Your obedient servant,

ROBT. MCALLUM,
Engineer Public Works.

STATEMENTS
OF THE
ACCOUNTANT
AND
LAW CLERK.

DEPARTMENT OF PUBLIC WORKS, ONTARIO,

TORONTO, January, 1900.

HON. F. R. LATCHFORD,

Commissioner of Public Works, Ontario.

SIR,—I have the honor to submit the following statements of maintenance and capital expenditure on public buildings and works, and of contracts entered into in connection therewith during the year 1899, being (1) the expenditure on maintenance and repairs account for Government and Departmental Buildings, Institutions and works for the year 1899 ; (2) the total capital expenditure for public buildings and works for the year 1899 ; (3) the total capital expenditure on public buildings and works from the 1st July, 1867, to 31st December, 1899, and (4) a statement showing the several contracts and bonds entered into with Her Majesty for the execution of sundry works under the control of the Department during the year 1899.

I have the honor to remain, Sir,

Your obedient servant,

J. P. EDWARDS,

Accountant and Law Clerk.

STATEMENT No. 1.

Being statement of expenditure on maintenance account for fuel, gas and water, repairs, vault fittings, furniture and furnishings, salaries, etc., for the following departmental buildings, institutions and works during 1899.

Name of Service.	Amount.
	\$ c.
Government House.....	7,459 50
Old Parliament Buildings.....	736 91
New Parliament and Departmental Buildings (including salaries of engineer, firemen, messengers, etc.)	31,596 79
Attorney-General's Department.....	573 15
Crown Lands Department	1,039 48
Treasury Department	880 93
Provincial Secretary's Department	899 25
Department of Agriculture	349 22
Department of Public Works	416 25
New Parliament Buildings, exclusive of departments (furniture and furnishings only)...	1,820 88
Educational Department, Normal and Model School Buildings, Toronto	7,427 21
Miscellaneous (salaries of clerk of works, carpenter and plumbers).....	3,570 00
Normal and Model School Buildings, Ottawa	3,668 54
School of Practical Science, Toronto.....	3,497 12
Agricultural College and Farm, Guelph	6,290 23
Osgoode Hall, Toronto	6,718 53
Superintendent of Locks and Dams	1,200 00
Lockmasters, bridgetenders and caretakers	3,637 25
Total	\$81,781 24

J. P. EDWARDS,
Accountant.

DEPARTMENT OF PUBLIC WORKS, ONTARIO,
TORONTO, January, 1900.

STATEMENT No. 2.

Being statement of Expenditure on capital account for the year 1899 only, on Public Buildings and Works.

See also Statement No. 3.

Name of Work.	Under the Department of Public Works.	Under the Inspectors, etc.	Total for 1899.
	\$ c.	\$ c.	\$ c.
Asylum for Insane, Toronto	711 18	3,722 89	4,434 07
do Mimico	129 96	2,793 61	2,923 57
do London	2,159 60	4,549 78	6,709 38
do Hamilton	2,027 26	1,296 08	3,323 34
do Kingston	2,850 34	1,366 84	4,217 18
do Brockville	4,462 20	3,665 23	8,127 43
Asylum for Idiots, Orillia	8 60	1,580 56	1,589 16
Reformatory for Boys, Penetanguishene	10 75	4,822 09	4,832 84
Andrew Mercer Reformatory for Females, Toronto ..	3 00	697 00	700 00
Central Prison, Toronto	45 00	3,004 32	3,049 32
Institution for Deaf and, Dumb Belleville	2 55	1,402 48	1,405 03
Institution for Blind, Brantford		1,515 77	1,515 77
Agricultural College, Guelph	1,704 35	2,558 88	4,263 23
Educational Buildings, and Normal and Model Schools, Toronto	1,128 24		1,128 24
Normal and Model Schools, Ottawa	259 29		259 29
New Normal School, London	42,837 97		42,837 97
School of Practical Science, Toronto	4,265 48		4,265 48
New Parliament Buildings, Toronto	169 59		169 59
Cobourg Institution	5,324 73		5,324 73
Eastern Dairy School, Kingston	177 50		177 50
Thunder Bay District :			
Lock-up, etc., Port Arthur	32 00		
do " Fort William	270 00		
			302 00
Muskoka District :			
Lock-up at Huntsville	36 93		
do " Bracebridge	7,223 39		
			7,260 32
Parry Sound District :			
Lock-up, etc., at Burk's Falls	9 30		
			9 30
Nipissing District :			
Court-room, etc., North Bay	483 75		
Lock-up at Sudbury	7 50		
Lock-up, etc., at Mattawa	327 94		
			819 19
Rainy River District :			
Lock-up, etc., Rat Portage	1,185 25		
Lock-up, etc., at Fort Francis	593 06		
Lock-up, etc., at Mine Centre	771 56		
			2,549 87
Georgian Bay Works	207 17		207 17
Snoal Lake and Lake of the Woods Improvements (Ash Rapids)	4,000 00		4,000 00

STATEMENT No. 2.—*Concluded.*

Name of Work.	Under the Department of Public Works.		Under the Inspectors, etc.		Total for 1899.	
	\$	c.	\$	c.	\$	c.
Gull and Burnt River Works	5,799	42			5,799	42
Otonabee River Works	192	11			192	11
Union Creek Works	200	00			200	00
Repairs and Maintenance, Locks, Dams, Bridges, etc.	9,079	12			9,079	12
Surveys and Inspections, etc.	358	25			358	25
High Falls Slide and Dam, Pigeon River (C.L.D.)			700	36	700	36
Star Lake Works	412	22			412	22
Madawaska River Works	1,500	00			1,500	00
Payne River Works	4,000	00			4,000	00
Squaw River Works	869	00			869	00
Total Public Buildings.....	\$12,193	80				
“ “ Works	27,318	64				
Totals.....	105,836	55	33,675	89	139,512	44

J. P. EDWARDS,
Accountant.

DEPARTMENT OF PUBLIC WORKS, ONTARIO,
TORONTO, January, 1900.

STATEMENT No. 3.

Being statement of expenditure on capital account for 1899, and total of expenditure up to the 31st of December, 1899, on public buildings and works.

Name of work.	Expenditure from 1st July, 1867, to 31st December, 1898.	Expenditure for 1899.	Total of expenditure to 31st December, 1899.
	\$ c.	\$ c.	\$ c.
Government House	183,860 86		183,860 86
Old Parliament and Departmental Buildings.....	85,285 98		85,285 98
New Parliament Buildings—construction account	1,273,052 60	29 22	1,273,081 82
do equipment, grounds, roads, plant house, etc.	226,968 43	140 37	227,108 80
Asylum for Insane, Toronto	360,636 50	4,434 07	365,070 57
do Mimico	594,583 21	2,923 57	597,506 78
do Brockville	459,562 88	8,127 43	467,690 31
do London	903,626 81	6,709 38	910,336 19
do Hamilton	880,032 16	3,323 34	883,355 50
do Kingston	443,813 66	4,217 18	448,030 84
do Kingston (branch)	9,422 82		9,422 82
Asylum for Idiots, Orillia	522,118 02	1,589 16	523,707 18
Institution for Deaf and Dumb, Belleville	313,024 92	1,405 03	314,429 95
Institution for Blind, Brantford.....	268,349 66	1,515 77	269,865 43
Reformatory for Boys, Penetanguishene.	176,768 91	4,832 84	181,601 75
Agricultural College, Guelph	475,770 10	4,263 23	480,033 33
Central Prison, Toronto	869,447 43	3,049 32	872,496 75
School of Practical Science (old building)	59,100 26		59,100 26
do do (new building and addition)	225,506 20	4,265 48	229,771 68
Andrew Mercer Reformatory for Females, Toronto...	217,400 40	700 00	218,100 40
Osgoode Hall, Toronto.....	141,730 92		141,730 92
Agricultural Hall, Toronto.....	324 00		324 00
Education Department and Normal and Model Schools, Toronto	176,810 60	1,128 24	177,938 84
Normal and Model Schools, Ottawa	214,375 18	259 29	214,634 47
Normal School, London	8,262 36	42,837 97	51,100 33
Cobourg Institution	10,025 70	5,324 73	15,350 43
Dairy School, Strathroy	14,583 71		14,583 71
do Kingston	7,800 61	177 50	7,978 11
School of Mining, Kingston	4,070 00		4,070 00
Government Farm, Mimico	51,646 34		51,646 34
Pioneer Dairy Farm, Algoma	5,178 43		5,178 43
Brock's Monument, Queenston Heights....	4,605 31		4,605 31
Niagara River Fence.....	8,025 43		8,025 43
Algoma District:			
Court House, Gaol and Registry Office, etc., Sault Ste. Marie.....	23,484 85		23,484 85
Grand Manitoulin Island, three lock-ups, (Gore Bay, Little Current and Manitowaning).....	17,070 37		17,070 37
Lock-up at Killarney	1,292 97		1,292 97
do Bruce Mines.....	3,117 48		3,117 48
do Webbwood	1,634 24		1,634 24
do Thessalon.....	1,221 99		1,221 99
do Massie	702 74		702 74
Thunder Bay District:			
Registry Office and Lock-up, addition to Court House and gaol, etc., Port Arthur	38,786 57	32 00	38,818 57
Lock-up at Fort William	8,681 60	270 00	8,951 60
do Silver Islet, Lake Superior.....	2,304 79		2,304 79
Muskoka District:			
Immigration sheds at Gravenhurst	355 00		355 00
Registry Office and Lock-up, Bracebridge.....	14,218 09	7,223 39	21,441 48
Lock-up and Court Room, Huntsville	8,170 72	36 93	8,207 65
do etc., Baysville.....	300 00		300 00
Parry Sound District:			
Registry Office, Lock-up, etc., Parry Sound	18,080 91		18,080 91
Lock-up at Magnetawan	645 56		645 56
do and Court Room at Burk's Falls.....	6,377 03	9 30	6,386 33

STATEMENT No. 3.—*Continued.*

Name of work.	Expenditure from 1st July, 1867, to 31st December, 1898.	Expenditure for 1899.	Total of expenditure to 31st December, 1899.
	\$ c.	\$ c.	\$ c.
Parry Sound District— <i>Cont.</i>			
Lock-up at French River.....	1,194 12		1,194 12
do Dunchurch.....	609 00		609 00
do Emsdale.....	300 00		300 00
Nipissing District:			
Lock-up at Mattawa.....	13,316 17	327 94	13,644 11
Court Room and Registry Office at North Bay...	26,576 41	483 75	27,060 16
Lock-up at Sudbury.....	12,057 53	7 50	12,065 03
do Sturgeon Falls.....	1,730 34		1,730 34
Rainy River District:			
Lock-up, Court Room and Gaoler's residence, New Registry Office, etc., at Rat Portage.....	32,503 04	1,185 25	33,688 29
Lock-up at Fort Francis.....	2,156 15	593 06	2,749 21
do etc., at Mine Centre.....		771 56	771 56
County of Haliburton—Registry Office, Minden.....	5,918 42		5,918 42
Young's Point Lock.....	31,192 72		31,192 72
Balsam and Cameron Lakes Locks.....	23,959 02		23,959 02
Mary's and Fairy Lakes Lock and Works.....	68,999 12		68,999 12
Magnetawan Works—Lock, dam and river improve- ments, and dam and slide at Deer Lake.....	63,668 25		63,668 25
High Falls, Pigeon River, slide, dam, etc. (C.L.D.)...	9,005 71	700 36	9,706 07
Georgian Bay Works.....	6,942 80	207 17	7,149 97
Landing Pier at Port Elgin.....	2,750 00		2,750 00
do Southampton.....	2,022 63		2,022 63
Muskoka lakes works.....	21,125 46		21,125 46
“ lock and bridges at Port Carling.....	44,211 96		44,211 96
“ cut and bridges at Port Sandfield.....	16,842 86		16,842 86
“ Muskoss Falls, works and bridges at Bala.....	7,223 96		7,223 96
Nipissing Lake works.....	9,182 17		9,182 17
Couchiching Lake works.....	427 84		427 84
Mud Lake works (Township of Dalton).....	1,502 32		1,502 32
Kushog Lake dam.....	300 00		300 00
Mississicua Lake dam.....	4,989 84		4,989 84
Star Lake works.....		412 22	412 22
Bottle Lake dam and Mississicua creek dam.....	4,068 72		4,068 72
Shoal Lake and Lake of the Woods improvements (Ash Rapids).....	1,998 25	4,000 00	5,998 25
Mill Creek improvement (Co. Prescott).....	500 00		500 00
Lake of Bays, dredging mouth of river at outlet of...	581 82		581 82
Peninsula Creek improvements.....	32,739 19		32,739 19
Stony Creek works (Township of Ops).....	828 25		828 25
Union Creek improvements.....	648 63	200 00	848 63
Scugog Lake works—dredging at Port Perry.....	977 53		977 53
Lake Scugog flats road.....	1,500 00		1,500 00
Cobb's Lake outlet.....	1,102 08		1,102 08
Gull and Brunt Rivers works.....	92,401 49	5,799 42	98,200 91
Muskoka River do.....	42,670 53		42,670 53
Sydenham do.....	2,156 26		2,156 26
Nottawasaga do.....	5,915 09		5,915 09
Kaministiquia do.....	22,865 02		22,865 02
Scugog do (including Lindsay lock and swing bridges).....	96,256 82		96,256 82
Pigeon do (County Victoria).....	4,999 62		4,999 62
Otonabee do.....	8,970 80	192 11	9,162 91
Balsam do.....	16,585 11		16,585 11
Wye do.....	5,176 98		5,176 98
Squaw do.....	818 17	869 99	1,688 16
Madawaska River—swing bridge at Combermere.....	971 50		971 50
Madawaska River works—bridge at Burnstown.....		1,500 00	1,500 00
Nation do.....	13,877 23		13,877 23
Nation River bridge.....	2,000 00		2,000 00
Nation River dredge (contribution).....	4,000 00		4,000 00
Beaudette River works (to aid in dredging, etc.).....	3,000 00		3,000 00

STATEMENT No. 3.—*Continued.*

Name of work.	Expenditure from 1st July, 1867, to 31st December, 1898.	Expenditure for 1899.	Total of expenditure to 31st December, 1899.
	\$ c.	\$ c.	\$ c.
Mississippi River improvements (below Carleton Place)	4,730 71	.....	4,730 71
Head River improvements (Townships of Laxton and Carden).....	976 82	.....	976 82
Moirs River improvements (Township of Thurlow)...	2,135 22	.....	2,135 22
Muskat River works	893 76	.....	893 76
Payne do .....	.....	4,000 00	4,000 00
Otonabee River bridge.....	2,500 00	.....	2,500 00
Trent do	2,000 00	.....	2,000 00
Washago and Gravenhurst road	32,792 12	.....	32,792 12
Washago wharf.....	489 22	.....	489 22
Portage du Fort bridge, Ottawa River.	5,747 99	.....	5,747 99
Des Joachims Rapids—bridges and approaches . . .	5,937 72	.....	5,937 72
Surveys, inspections, arbitrations and awards, etc....	46,632 73	358 25	46,990 98
Repairs and maintenance of locks, dams, slides, bridges, etc	138,389 10	9,079 12	147,468 22
Roads in Township of Ryerson.....	7,295 06	.....	7,295 06
Clearing and log houses on free grant lands (settlers' homestead fund).....	16,780 75	.....	16,780 75
Surveys and drainage of swamp lands (Provincial account).....	36,600 51	.....	36,600 51
Aldborough drainage works	7,199 02	.....	329,980 93
Brooke do	34,747 73	.....
Delaware do	5,740 93	.....
Dunwich do	10,105 86	.....
Ekfrid, Caradoc and Metcalfe drainage works	13,667 66	.....
Grey drainage works	8,175 47	.....
Moore do	17,091 58	.....
Mosa do	12,714 75	.....
Nissouri West drainage works	8,178 50	.....
Raleigh do	33,009 64	.....
Russell do	11,543 77	.....
Sarnia do	40,540 55	.....
Sombra do	53,169 04	.....
Tilbury East do	35,297 62	.....
Tilbury West do	31,577 06	.....
Williams East do	2,221 75	.....
Totals.....	10,754,414 88	139,512 44	10,893,927 32

J. P. EDWARDS,

Accountant.

DEPARTMENT OF PUBLIC WORKS, ONTARIO,
TORONTO, January, 1900.

STATEMENT No. 4.

Being Statement of Contracts, Bonds, etc., entered into with Her Majesty in 1899.

Date.	Service.	Subject of Contract.	Contractor.	Sureties.	Description	Amount.
Feb. 21...	Maintenance of locks and dams, etc.	Hemlock and oak timber and pine planking required in the reconstruction of a portion of the slide at Elliott's Falls.	Thomas J. Stephens and John C. Argue both of the Village of Norland.	James B. Campbell of the Township of Laxton, and Thomas Argue of the Village of Norland.	Hemlock timber per foot lineal measure Oak timber per foot lineal measure Pine planking per thousand feet board measure.....	\$ c. 09½ 35 12 00
Feb. 22..	Maintenance of locks and dams, etc.	White pine and hemlock timber, and white pine planking required in the construction of a dam across the Indian River at Port Carling.	William H. Fairhall of the Township of Medora, in the District of Muskoka.	Walter Fowler and Walter Scriver, both of the Township of Medora.	White pine timber and planking per thousand feet board measure..... Hemlock timber per thousand feet board measure.....	13 00 6 50
Feb. 22..	Maintenance of locks and dams, etc.	White pine timber and planking in the re-construction of the dam across the southerly outlet of Muskoka Lake at Bala.	William H. Fairhall of the Township of Medora, in the District of Muskoka.	Walter Fowler and Walter Scriver, both of the Township of Medora.	White pine timber and planking per thousand feet board measure Hemlock timber per thousand feet board measure.....	13 00 6 50
March 4..	Squaw River works.....	Hemlock and pine timber required in the construction of a dam on Squaw river at outlet.	John Carew of the Town of Lindsay.	None	Hemlock and pine timber per foot lineal measure.....	08½
March 6..	Gull and Burnt rivers works.	Hemlock lumber required for the re-construction of dam and slide at outlet of Little Bob lake.	Charles Russell of the Township of Lutterworth.	None	Hemlock timber per foot lineal measure	07
March 13.	Gull and Burnt Rivers works.	Hemlock timber required for the reconstruction of dam at outlet of Big Bob lake.	James Mortimer of the Township of Lutterworth.	None	Hemlock timber per foot lineal measure	08
May 13 ..	Asylum for the Insane. London	Slating and galvanized iron work to roof of the west wing of the north building.	Samuel Stevely of the city of London. (William Stevely & Son.)	None .....	.....	1,338 00

June 6 ...	(Government House, old Parliament buildings, new Parliament and Departmental buildings, Educational Department and Normal School, School of Practical Science and Osgoode Hall, Toronto.)	Supply of grate, egg, stove, nut and pea size hard coal, Straitsville lump, soft coal, hardwood, pine wood, slabs, and softwood charcoal for season 1899-1900.	William McGill of the city of Toronto. (William McGill & Co.)	Samuel Crane of Toronto, and John Colgan of Toronto.	Hard coal, grate, per ton... " egg, stove and nut, per ton... " pea Soft coal, Straitsville, " Hard wood per cord... Pine wood and slabs, " Charcoal per bbl.....	4 65 4 75 3 85 4 40 5 40 4 00 75
June 9 ...	Normal and Model Schools, Ottawa.	Supply of 300 tons of standard Lackawanna egg hard coal for season 1899-1900.	Cassius C. Ray, Denis Murphy and John W. McRae, all of Ottawa. (C. C. Ray & Co.)	John M. Hurcomb and M. J. Birdwhistle both of Ottawa.	Hard coal, egg, per ton ...	4 40
June 9 ...	Normal and Model Schools, Ottawa.	Supply of 30 cords of hardwood for season 1899-1900.	John Heney & Son of Ottawa.	William G. Black and F. X. St. Jacques, both of Ottawa.	Hard wood, per cord.....	3 45
July 11 ..	Normal and Model Schools, Ottawa.	Supply of 50 cords of elm and ash dry wood for season 1899-1900.	Frank O'Reilly of Ottawa.	Napoleon Belanger and John O'Reilly, both of Ottawa.	Elm and ash wood, per cord	1 90
July 24...	Agricultural College, Guelph.	Building a new chimney for the engine room.	Samuel Rundle of Guelph.	David Young and Thomas C. Rundle, both of Guelph.	.....	1,194 00
July 24 ..	Muskoka District ...	Construction and erection of a new court house at Bracebridge.	James R. Eaton of Orillia.	Crawford James Miller and Melville Miller, both of Orillia.	Whole work.....	8,959 00
July 28 ..	Normal and Model Schools, Toronto.	Construction of concrete sidewalk in grounds.	The Credit Forks Mining and Manufacturing Co., Toronto. (J. H. McKnight.)	None	Per superficial foot.....	21
July 28 .	School of Pract Science, Toronto.	Fitting up additional rooms in attic and construction of a skylight over same.	Henry Winsor and William Woodley, both of Toronto. (Winsor & Woodley.)	None .....	.....	437 00

STATEMENT No. 4.—Being Statement of Contracts, Bonds, etc., entered into with Her Majesty in 1899.—*Concluded.*

Date.	Service.	Subject of contract.	Contractor.	Sureties.	Description.	Amount.
Aug. 30 ..	Rainy River District....	Hot water heating apparatus to be erected in court house at Rat Portage.	John L. Wells of Winnipeg. (J. L. Wells & Co.)	None	Whole work	1,251 00
Sep. 9.....	Thunder Bay District ..	Erection of an addition, for kitchen to the lock-up at Fort William.	Donald McLean and Louis Fregeau, both of the town of West Fort William.	None	Whole work	270 00
Nov. 1...	Asylum for the Insane, Hamilton.	Erection of an ice house on the asylum grounds.	James Cleynes of Hamilton.	None	Whole work	850 00
Nov. 2...	Government House, Toronto.	The electric wiring of the building.	The Electrical Maintenance and Construction Co'y. Limited, of the city of Toronto.	None .....	.....	759 00
Nov. 4...	Normal School building, London.	Construction and completion of steam heating, plumbing and gas fitting works.	John Purdom, of London.	Alexander Purdom and Thomas H. Purdom, both of London.	Whole work	10,595 00
Nov. 28 ..	Normal School building, London.	Complete installation of electric light wires.	Joseph Rogers, of London. (Rogers Electric Co'y.)	Thomas Hullock and George C. Gibbons, both of London.	.....	587 00
Dec. 27 ..	Government House, old and new Parliament buildings, Education Department and Normal and Model School buildings, Osgoode Hall and Andrew Mercer Reformatory buildings, all of Toronto.	Keeping the roofs and gutters, etc., clear of snow and ice during the season 1899-1900, and leaving same in a perfect state of repair on 1st April, 1900.	J. J. Power, of Toronto ...	None	Government House	19 00
					Old Parli't Bld'gs	24 00
					New do	48 00
					Education Dept., etc	28 00
					Osgoode Hall	33 00
					A. M. Reformatory	23 00
					Total	175 00

PUBLIC WORKS DEPARTMENT,
Toronto, January, 1900.J. P. EDWARDS, *Law Clerk,*
Public Works Department.



TWELFTH ANNUAL REPORTS

OF THE

INSPECTORS OF FACTORIES

FOR THE

PROVINCE OF ONTARIO

1899.

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.)

PRINTED BY ORDER OF
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1900.

TWELFTH ANNUAL REPORTS
OF THE
INSPECTORS OF FACTORIES
1899.

WESTERN DISTRICT.

To the Honorable the Minister of Agriculture:

SIR,—In my last report I alluded to the improved state of the manufacturing business, and this year I found the improvement maintained and extending to all branches of manufactures to such an extent that in many trades it was impossible to get sufficient employees for their purposes. Several employers told me in Toronto that they had advertisements in the city papers for two weeks for females to work at the sewing trades and did not get an application; and I found the factories outside of Toronto, in the Western district, all busy; many of them working overtime all the law allows, and some of them more, till they were stopped. Several large factories worked night and day with a double staff of employees, where it was possible to get them. To this improved condition in the manufacturing trade an increase of wages followed, as a sequence, in many industries, especially in those which had reduced wages during the depression. This had a satisfactory and cheering influence on the workers. Another effect of the amelioration in the condition of trade was the greatly increased number of accidents reported, of which I will write more at length in connection with accidents.

OVERTIME.

Of overtime permits I have this year issued one-third more than usual. These permits are necessary only where females are employed, and therefore give no correct impression of business in factories where males only are employed. There is no law regulating the hours of labor for males, except as to bakers, who are limited to sixty hours a week.

VENTILATION.

I have had a few complaints of excessive dust in some factories, principally manufacturers of bicycles, and in one foundry, some of which have been remedied and the proprietors have promised to have the matter attended to. Some workers take the ground that where there is only one emery wheel in operation there should be a fan attached for removing the dust generated. This, of course, most employers object to, on the ground that the dust is not in as great a quantity as to warrant the expense of putting in a fan or blower. In other places I have been met with the objection that they have barely power enough to drive the present machinery, much less to drive a fan in addition, and that to provide a more powerful boiler or engine, or both, would involve too great an expense. It is arguments like these that bother me as to what to do in the matter. I wish to do justice to the workers and to the employers, and sometimes I reach a deadlock. There are complaints of excessive dust in many small places, not coming under the operation of the Factories Act, but here the Inspector cannot do anything to

relieve the workers, though the evil may be greater than in larger factories. In such cases the only relief I can suggest is for the workers to watch their chance to get employment in some better equipped factory, and possibly the difficulty of getting employees to work under such dusty conditions will cause the owners to improve matters. When there is a good understanding between the polishers' union and the employer there are few complaints, but it is quite a different matter when all is *not* harmonious. All complaints with respect to ventilation and dust have been investigated, and the cause of complaint has been, or is being, removed as far as possible in most cases.

CHILDREN

I have found but few children illegally employed this year. The "Compulsory School Attendance Act" being locally looked after by the school trustees, is having the effect of assisting the factory inspectors in this respect. Besides, the majority of employers are law-abiding and law-respecting, and, when they know what the law requires, will conform to it; at least, such is my experience with them. When the "Compulsory School Attendance Act" first became law, it led to considerable misunderstanding in some localities. Many persons had the idea that children not going to school during holidays could then work in factories, and as a consequence the first year or two after that law was enacted, I found quite a few children at work during the summer holidays. Then there are some would-be public guardians who, seeing a small child on the streets near a factory, infer that because the child is small it is under the factory age. I have seen whole families quite small, though old; and size is not always a criterion of age. In Toronto there may be many children seen in the streets near factories, but it does not follow that they are workers in them. I am glad to say that in regard to the employment of children the law is very well observed, and without much friction to parents or employers.

CLEANLINESS.

I am glad to be able to report that more attention is being given to cleanliness in factories, or rather that the improvement in this respect, noticed some years ago, has been continued and extended, both as to lime-washing walls and ceilings and to scrubbing floors of workrooms, passages and stairways.

In canning factories, where fruits, vegetables, meats and fowls are packed, I am pleased to bear witness to the marked improvement in their condition, compared with that which prevailed in some of them in my early visits, some twelve years ago. All is now as clean as in an ordinary kitchen. I feel inclined to take to myself some of the credit for this, for in my early reports I spoke of them as I found them, and this, I fancy, spurred up the careless ones to have a greater regard for cleanliness and sanitation. The proprietors of these industries seem to realize the importance of their trade, and also that of the health and safety of their workers. Very few accidents have been reported of late years from them.

BAKE SHOPS.

Bake shops I have not visited generally, but for the most part I confined my visits to those about which I have had complaints, which were all on the score of beginning to work too early on Sunday night. I have not had a complaint on any matter about bake shops in six months, so I take it that the Act is being fairly well observed.

SHOPS AND PLACES OTHER THAN FACTORIES.

The shops and places coming under this Act fall mostly under the supervision of Miss Carlyle, as they are mostly females employed therein. She will report on the observance of this Act.

FIRES.

There have been the usual number of fires in factories this year, but fortunately taking place after working hours, with the exception of one in the Mattress factory in Toronto in the afternoon on August 15th, an account of which I have written in connection with accidents.

During this fire one female was injured, the only instance I am aware of as happening in the western district, or in the whole Province, of injury by fire in a factory this year. Such fires have been and are a source of anxiety to me, and I have not hesitated to order a fire escape where I thought it necessary.

Here I take the opportunity to suggest that the law be changed as regards the proper person to provide the escape, or rather to bear the expense of erecting it. As the law is now all changes required in or about factories must be borne by the occupier. I think that all changes to buildings, such as providing closets, making elevators and hoistways safe, doors to open outwardly, mill gearing made safe, etc., should be borne by the landlord, or owner: that they should have their buildings in accordance with the requirements of the Factories Act when they let them to an occupier. I have frequently had occupiers tell me, when I ordered a fire escape, that they would vacate the premises before they would erect one. That, I think, is a hardship. When struggling to make a living with hardly money enough to pay current expenses, to take from his scanty capital \$200 to \$400 to erect a fire escape probably to reach from the fifth storey to the ground and the wealthy owner of the property to escape this expense. Or take, for instance, a five or six storey building let out to tenants, some of which come under the operations of the Factories Act and some not. The tenant on the top storey does and is required to provide a fire escape; none of the occupiers below him, however, come under the Act, and so they are not at any expense in this respect; and besides, if a fire occurs they will avail themselves of the upper tenant's escape. While if other tenants do come under the Act there is no provision made for united ownership in a fire escape nor to cause the different tenants to combine to erect one. It seems to me that it would be right to leave it to the Inspector to make either the owner, tenant, or both, contribute to the expense, and the same with all changes to the property that the owner provides. Of course such machinery as the occupier provides he alone shall see that it be in accordance with the Act, and so with the landlord, whether as to machinery or building. In examining factories I gave considerable attention to the means of exit in case of panic, and till lately, in Toronto, I relied on timely assistance from the Fire Department, but the fire in the Bay street Mattress factory has shown me that I was leaning on a weak reed, for when they reached the scene of the fire they had not a ladder that would reach to the third storey, where a young woman was sitting on the window-sill awaiting their coming. So I have determined to take no risk as to fire, but to see that every factory employing workers above the second storey will have at least two exits, though not necessarily either of them outside. I have not unlimited faith in the iron fire escape, nor in any one escape. After the burning of the Windsor Hotel in New York, where so many lives were lost—and in the day time too—my confidence in most things human has been shaken. All I can do is to have the law complied with and trust that no fires occur. I warn employers and foremen to be careful and dispose of waste, cuttings, etc., so as to avoid a fire, for one ounce of prevention is worth a pound of cure. In most moderately-sized factories there are pails, barrels, hose, and other implements for speedily extinguishing an incipient fire. But in some industries a fire rapidly spreads and in a moment is beyond control.

EXPLOSIONS.

During the year only two explosions have come to my notice, both of boilers

On January 20th a small portable boiler, belonging, I believe, to Alderman Burns, used for hauling up ice to store in the ice-house, exploded, killing one man and injuring three others. At the coroner's inquest it was developed that the boiler was old and weak; no stays to the head. The verdict was: "Attendant was careless and incompetent."

On December 21st, at the Crescent Mill and Lumber Co.'s Works, London, a boiler exploded about 7 a.m. There was only one man on the premises at the time, and he was not much hurt. The boiler was an old one, and rusted. Steam pressure at the time of explosion was between 30 and 40 pounds. The water gauge showed three inches of water. The boiler was thrown some distance and the house wrecked. The report of the explosion states: "The explosion of our boiler was evidently caused through the weakness of the plate in one of the heads, which gave out and caused the accident. A small segment of the boiler-head blew out forward and the boiler went in the other direction. A man was sitting in the boiler-house, but escaped under the column of water and steam, as it shot upwards. It was a second-hand boiler, which had been repaired with part of a new head. The part that blew out was the old part which had been left in." It is clear from this that a chain is no stronger than the weakest link, and that a boiler is no stronger than the weakest part. A foot-note to the report of the explosion says: "There could not have been more than 30 or 40 pounds of steam on when it went out, and it had been running every day with 80 pounds." The mill hands, and probably others, had a narrow escape when the pressure was 80 pounds.

ACCIDENTS.

The accident list for the year 1899 was a surprise to me, for in writing in this respect in 1897 I expressed the view that the number of accidents had been reduced to the lowest extent. I thought probable, and I had the hope that the number would not materially increase in future, except in the proportion as the workers increased. There were 99 accidents for the year 1897—the lowest period of the depression in trade, and 102 accidents for the year 1898; but this year's record shows that 157 accidents have been reported. The inference to be drawn by unthinking people is that dangers are not as well protected as formerly; but those who reflect will seek for other causes for the increase. I attribute it to several causes: First, there are more factories coming under the operation of the Act than formerly. Second, there are more people employed in many of the previously existing factories. Third, there have been many factories during the year 1889 working from one-fourth to a full day overtime for a great portion of the year with a double staff of employees. Fourth, to a change in the law of the class of accidents to be reported. And, lastly, the better observance of the law in regard to reporting accidents, through my exertions. Accidents may be classed into those that are preventable (by law), and those that are unpreventable, which are those occurring from some occupation which is accompanied by more or less danger, which the law does not guard against, depending on the care and watchfulness of the workers themselves. There are many such occupations, and often a slight inattention or carelessness will cause an accident, sometimes most serious in its results. A glance at the list of accidents will show that by far the greater number of accidents reported in 1899 are of the unpreventable class, *i. e.*, cannot be guarded against. I foretold in my last report that I might expect an increase in the number of accidents reported, because I was determined to have the law better observed in this respect; and I have been to considerable extra trouble to ascertain if any happened, and, if so, to have them reported. To these efforts I attribute a portion of the increase in the number of accidents reported. Of course the other factors are not to be ignored, *viz.*, the improved condition of trade, giving rise to a greatly increased number of employees and the lengthened

working day; for in some trades the longer time the worker is on duty the greater the chances of meeting with an accident. And also when there is such a demand for manufactured goods that factories have to work unusually long hours, the employees do not get their proper rest, and, therefore, are not so much on the alert, and are more prone to get hurt. I do not say that this is the result of carelessness, but of a want of care, which is quite a different matter. There are some industries so dangerous that the workers need to be always watchful, and that is nearly impossible, even to those who have had proper rest, and much more so to those who, instead of rest and recreation, are still grinding at the weary mill. Then, in 1897 there was a change in the law as to what accidents should be reported, and this change has added to the list all of whatever nature occurring while attending to ordinary occupation and disabling employees from returning to work within six days. If an employee in a factory slip or fall on the floor of his work-room or place, and is laid off work as a result for six days, it is a reportable accident. I can see no object in having such reported. Whoever suggested that change did not comprehend the Act as it was. What is the object of reporting any accident? So that the Inspector will visit the place where it happened, if needed, with a view to suggesting some protection to prevent a recurrence. No Inspector would think it necessary to visit a factory because he received a report that a worker was hurt by falling on the floor, when probably the cause of the worker's falling lay in the fact that the heels of his boots were so worn down as to be dangerous. I think the law as it was answered very well. Accidents are not required to be reported for the purpose of statistics. If that were the case the reporting of all, from whatever cause, would be quite proper, but when the reason for having them reported is only for the purpose of lessening their number, there can be no object in reporting those from any cause that shows protection cannot be afforded. There were quite a number of accidents reported during the year 1899, unpreventable, by slipping or falling off a lumber pile, etc.

In looking over the list of accidents, I find that 84 happened in the wood-working industries, and those industries which use one or more wood-working machines in connection with their ordinary business. Some fair-sized factories in different lines of manufacture have circular saws, planers, drills and iron-turning lathes for the purpose of making packing-cases and general repairs. So I have classed accidents as happening from wood-working machinery as in connection with the wood-working business, though in the appended list of accidents they will appear in connection with the ordinary business of the employer reporting them.

In connection with machine shops and foundries there is usually a carpenter shop for the purpose of making patterns, flasks, and for general utility, and so with many other industries. I make this explanation in order that it will be the easier understood when a woolen mill, machine shop and other industries, not supposed to require dangerous wood-working machinery, reports an accident from saw or planer. The machinery of the wood-working industries is of a very dangerous character from its very nature, and while something can be done to lessen the dangers of saws and planers of different kinds, there is still left exposed as much of the saw or planer knife as is necessary for the width of wood to be operated upon, which it seems impossible to protect. I knew of a case last summer where a man was operating a buzz planer, putting through short lengths of one inch boards about 4 feet long, and planing the edge. There was a fence, as it is called, on one side of the planer, and the knife gap was all covered excepting one inch, the thickness of the lumber to be planed. The operator at this work is supposed to rest one hand on the fence, to hold up the board by sliding his hand along. But in this case it was done differently. The worker placed his hand on the rear end of the board and after the stick or board had passed over the

knives he carelessly let his hand fall into the only part of the knives exposed. Here, I think, was a great want of care, and it meant a loss of two fingers. The wood-working machinery is responsible for about 54 per cent. of all the accidents of 1899. In the metal industries I have recorded 55 accidents, or about 35 per cent. of the whole, happening in bolt works, agricultural implement works, bicycle works, foundries, saw works, engine and machinery works, radiator and metal stamping works. Though the metal stamping trade has been good there are many less accidents reported from it than formerly, owing, I think, largely to employing older labor. It is rare to find a boy under 16 years of age now at this work in the Western district. The remaining 23 accidents happened in various industries, as follows: starch, 1; textiles, 3; hosiery, 1; cottons, 1; white-wear, 1; dress shields, 1; biscuits, 2; paper box, 1; brewery, 1; chocolate, 1; mattress, 2; curled hair, 1; wall paper, 2; envelopes, 1; pork packing, 1; laundry, 1; tannery, 1; medicine, 1. Some of the above accidents are peculiar to the industries in which they happened, but others are such as might occur in any manufacturing business, *i.e.* those happening from shafting, elevators, weight falling, belts, gears, slipping, falling, and others.

FATAL ACCIDENTS.

Of fatal accidents I have had eleven reported, as follows: on January 25th, at the Verity plow works, Brantford, Samuel Westway was killed by the collapse of the drying kiln over the boiler house. He was working below and the falling lumber caused his death.

On January 11th, at the Cosgrove Brewing Co's works, Toronto, Wm. Hays was found unconscious at the foot of the stairs on the floor of the malthouse. It is supposed he fell down stairs, thereby receiving injuries so severe as to cause his death three days after.

On March 6th, at W. H. Storey & Sons' tannery, Acton, Robert J. Wilson, 16 years, was killed by being wound around a shaft. He was alone at the time, being sent by his father, who is foreman, to lace a belt. His cries for help were heard by some of the workmen in another part of the building. The engine was stopped and the lad released; he was badly mangled and only lived one hour.

On April 4th, at the saw mill of Mr. John Findlay, at Owen Sound, Duncan Campbell, 40 years old, was injured by a board thrown from a saw, and died April 7th.

On March 16th, at the Owen Sound Iron Works, Jas. Agnew, furnace man, was sitting on the edge of a tank of hot water, after casting, when he fainted and fell back into the water. His back was scalded from hips to shoulders; also his arms, his head being saved by resting on the opposite side of the tank. He died on the 18th.

On May 3rd, at Kennedy & Davis' saw mills, Sycamore Siding, Chas. Dawson was killed by being struck by a belt which was flying around a shaft.

On August 28th, at P. & P. Griffin's factory, Toronto, manufacturers of curled hair, Alfred Nightingale, 17 years, was killed by the bursting of the cylinder of the hair picker. I can account for the accident only by inferring that one of the lags became loose at one end when the high velocity of the cylinder would force the steel teeth on the loosed lag to come in contact with the iron concave in front of the machine, which would bend or break the lag, and cause all to occur which did occur. The steel lags were held fast to iron rings on the cylinder by set screws with heads countersunk. Each lag had a row of steel teeth in it which passed close to the concave. It is likely that the jarring caused by the teeth jerking in the hair caused a set screw to become slack and allow a little play, which gradually increased till it came in contact with the concave, and thus caused the wreck. This will account for the accident and is probable.

On Nov. 15th, at the Noxon Bros.' Mfg. Co. Works, Ingersoll, Charles Foster, aged 22, was killed. No one saw the accident, but it is supposed the unfortunate man in some mysterious manner fell into the large fly wheel of the engine and was whirled around to his death. He was not regularly employed in the engine and boiler house, but his brother was engineer, and he was helping him temporarily.

On November 17th, at the Canadian Packing Co.'s Works, London, Niels Peterson, aged 30 years, was killed. No one saw the accident, but he was known to be up on a ladder to place a belt on a pulley, and he was instantly killed.

On November 7th, at the biscuit and confectionery works of Messrs. Doerr & Co., Berlin, Hugo Knell, nearly 28 years of age, was killed by falling down an elevator shaft. Messrs. Doerr & Co. were having the elevator changed from hand power to steam power operation. It was nearly completed, but they had not yet accepted the work from the contractors as the platform would stick at the top, and employees were warned from making use of it till it was put in proper working order. It is thought that the deceased disregarded the warning, took the platform to the top storey where it stuck fast, when he reversed the shifting cable to descend; the platform did not move, being stuck, but the cable continued to unwind. It is thought he caught hold of a side rod brace of the platform to shake it loose, which it did and, pretty suddenly, pulled him into the shaft and he fell to the bottom, with the result of cracking his skull. He lived only about six hours.

On December 4th, at the works of Messrs. Hay & Co., Woodstock, Edmund Yeoman, aged 19 years, was walking across an open vat of hot water used for boiling logs in making veneers; he fell in and died shortly after. He was not working at the vats at the time.

Death by accident is generally supposed to be the greatest calamity that can overtake one, whether deceased be a factory operator or not. But it is a debatable question if death is not preferable to being so badly maimed as to be unable to maintain one's self, and to have to be a burden to one's friends or the community at large. However, I do not see that the factory inspectors could have done anything to have prevented any of the fatal accidents. Heedlessness and want of care is responsible for some of them, and sheer bad luck or misfortune for others.

A most singular and unexpected accident happened to Willie Moore, aged 18. He fell down between the elevator platform and the well wall, through a space only $9\frac{1}{4}$ inches wide, to the bottom, a distance of 40 feet. His hip was injured. He was helping to take off a small machine and stepped back on the platform and suddenly disappeared. One would think that an average sized boy of 18 years could not get through a space of $9\frac{1}{4}$ inches. He was very fortunate that he was not seriously injured.

ACCIDENTS TO FEMALES.

I have had reported to me this year six accidents to females, three of them losing one or more fingers. The most serious happened to Ethel Fahey, aged fifteen years. She had her hand crushed in a creasing press—one operating like a small printing press, with the platten opening in front. She had thrown off the belt and stood on the brake, but the momentum of the machine caused it to continue to move. Her hand was resting on the platten, which moved up to the form, and was so badly crushed as to render amputation necessary. One girl had her fingers cut in a staying machine.

Mary Cronin, a young woman, was working in a mattress factory, on the third floor, when a pretty lively fire started in the grass used for filling, near the stairs. She thought she could not escape by the stairs, so went to the windows, expecting to be released by the ladders of the fire department, but when they came they had no ladder long enough to be of service. Some persons held a

mattress and she jumped about 35 feet. She was rather severely burned about the upper part of the body: is not disfigured, but her physician says one arm is permanently injured. Her father sued the employers under the Workmen's Compensation for Injuries Act, and when the case was called the parties got together and effected a settlement by defendants agreeing to give Miss Cronin \$650 and costs. This action was on the ground of negligence in not conforming to the requirements of the Factories Act as to the safety of employees, by not having provided sufficient means of exit from their factory. The publicity given to this case by the newspapers is having the effect of causing employers to take all proper precautions for the safety of their employees, not only as regards injuries from machines but also as to injuries from fire or other causes. I may say in regard to this factory, that when I called to inspect it the owners told me they did not employ sufficient hands to bring them under the operation of the Act, so I did not go through, as I had no right to do so. And, later, when the number of employees exceeded five, bringing them under the operation of the Factories Act, they neglected to notify me that they were occupying a factory, as the law requires. Miss Carlyle and Mr. Brown, inspectors, equally with myself, complain that employers change their place of business without notifying the inspectors. We have been lately seriously considering the advisability of prosecuting a few of the delinquents, which would be a warning to others. For their own sakes it would be better, in view of some probable future litigation, that the place had been inspected. I have been called as a witness in many of these cases of compensation for injury, sometimes for plaintiff, sometimes for the defendant, and at other times for both, and I note a disposition on the part of the lawyers conducting the cases to try to establish negligence on the observance of the Factories Act by omitting to provide loose pulleys, belt shifters, etc. I have always held that the Act does not empower inspectors to deal with such matters. They have to take the machines as they find them, except guarding, as far as practicable, any dangerous parts. I believe belt shifters and loose pulleys will prevent a number of accidents which need not occur if ordinary care is used. Others again have pleaded that the machine causing the accident was obsolete, old fashioned, far inferior in many respects to those of more modern construction. This may be, and is in some cases, true; but the Inspector can only deal with such machines as are in use, without regard to whether they are of ancient or modern build, and I think any other view would be absurd, for there are continually new inventions and improvements in machinery, and the employer who has not the latest improved machines would be held to have been negligent.

In going through a wood-working factory I may notice a saw quite unguarded and draw the attention of the proprietor or foreman to it, and in such cases I am often met with the objection that to protect it is impracticable, for it would materially decrease the production, probably to the extent of 25 per cent., which meant that it was not practicable to guard the saw. I tell him that the risk is his, and that if he be made defendant to a suit for compensation on account of an accident happening from the saw not being protected, he will have to satisfy the jury that it was impracticable to guard the saw, and sometimes that is a difficult task, when it is shown that similar saws, doing similar work in other factories, are guarded. The same remarks well apply to other machines and to other industries.

LITIGATION.

Mentioning the possibility of being defendant in a suit has suggested to me to say a few words on "The Compensation for Injuries Act." There have been more suits under this law, during the past six months, than at any previous like period. One reason is that the more accidents the greater likelihood of more actions at law. Another reason, I am informed, is the enterprise of the lega

gentlemen, some of whom, when they learn of an accident of a serious nature, hunt up the injured person with a view of persuading him to begin an action. I am not taking any exception to this, for it is merely introducing into the legal profession the methods employed in ordinary business. Some of the medical profession have spoken to me about the possibility of a successful action at law in cases where there was a doubt of getting their pay for attendance on an injured workman. So they are also interested in The Compensation for Injuries Act, and with these two great forces at work it is not to be wondered at that suits under that law have increased. It is a good law, if it is not abused, and employers do not object to the principle of being held liable for injuries happening through their own negligence; but they object to pay when they think the fault was carelessness on the part of the injured person, that is contributory negligence, or that it could have been prevented by the exercise of ordinary care.

The law that was passed last year, amending The Compensation for Injuries Act, by having the matter settled by arbitration, instead of going into court, is in my opinion a good one, but I don't know of any cases being settled by it so far, and I am surprised at that. But I do not know that I need be when I reflect how helpless in these matters the ordinary workman is without competent advice. He goes to a lawyer, who says nothing about arbitration, but informs him, probably, that he has a good case to go to court. So arbitration is not heard of by the injured workman. The law leaves the choice of having the case arranged by arbitration to the plaintiff. It must originate with him, and the employer may object successfully. I think it will be a less expensive mode of procedure; but I doubt if it will be generally known to workers for the reasons given above.

ELEVATORS.

Elevators are responsible for seven accidents this year, and I fear that there is little chance of totally preventing accidents from this cause, unless some wholly different devices are discovered and adopted. They would no doubt be materially reduced by having elevators in charge of attendants, and allow no one else to operate them, and to have the doors open only from the inside and to be self-closing. There are automatically opening and closing doors, but they are liable to get out of order, which is a great drawback to their universal adoption. The Factories Act of this Province calls for self-closing doors, and that is easily arranged, with weights or springs: but if in use much the doors are fastened back and frequently left so, to the great danger of those who have occasion to pass near them. The device by which the shipper cable is locked so as to prevent the platform from being removed from the floor on which it was left is good, and should be put in all power hoists and elevators that are not operated by one person appointed for that duty. The absence of some such a device has been the cause of many very serious accidents. Last February a boy 15 years of age fell down the elevator shaft from the third story. He took the elevator up for some empty paper boxes, and stepping off the platform picked up the boxes in his arms. He could not see over them, and in stepping, as he thought, on to the platform, he fell to the bottom, as the platform had, during the time he was picking up the boxes, been removed. The lock I mentioned, if used, would have prevented the car being removed. There is no certainty that the lock would have been used if there, but that shifts the blame. All elevator accidents do not arise from falling down the shaft. Some happen from leaning out from the platform and being caught between it and the floor above. This could be remedied by raising the sides of the car to the height of a man's head. Some occur in looking into the well from above and the car or platform coming down and pinioning them. This could be avoided by the well shaft being boarded in higher, so it would be impossible to look over. Some happen from having the feet projecting over the

edge of the platform and being caught between it and some projection in the well or in door openings, which, when I thought were dangerous, in this respect, I suggested the corner being bevelled off so the boot would be pushed back. Other accidents happen from careless loading. Cases are not put on clear, and when the elevator moves up, the case catches some obstruction and is moved or upset, to the injury of the worker. I was in a large woolen mill last year, and was surprised to see a man going up on the elevator platform, taking up an empty warp beam, the looms were on the ground floor and the warping was done on the top flat, and the beams were brought down full and taken up empty on the elevator platform; they were beams for broad looms and must have been 16 or 17 feet long—journals included. Now, to get a beam 17 feet long through a hole in the floor about 8 feet square, required some manœuvring to get it up without mishap. It was in a low truck, having one end slightly elevated so as to be wholly on the platform, while the lower end projected out beyond; in going up, the attendant, as soon as the higher end of beam passed the first floor, shoved it forward till the lower end came flush with the platform, then he got ready for the next floor, by placing the beam as in the first instance. I considered it a very dangerous proceeding, for if the man was an instant too slow in moving the beam it would catch the floor and probably swing the beam around and throw him off the car, and probably break the lifting cable or do other serious damage. I saw the proprietor and told him it was very unsafe and that if continued there would be a serious accident some day, and advised him to make some other arrangement. He told me he would consult a builder of elevators, and have one especially for the purpose of carrying the beams constructed. I may mention that in this same factory the elevator is in the tower, with stairs built around it. When I first saw it the openings in the floor were not protected, and it was very dangerous, for the employees had to pass them to get to the workrooms, in a passage about three feet wide. I asked the proprietor to guard the openings, which was done, but in very frail manner; and one day a young man employee leaned too heavily against the fence, pushed it in, and he fell down, but fortunately before he reached the bottom he managed to seize the cable and check his fall so that he was but little the worse, as he was out bicycling next day. So this accident does not appear on the list, he not being prevented from returning to his work within six days, while many from much less cause have had much more serious consequences. I afterwards mentioned to the proprietor that he might have had a man's death on his conscience. He promised to have all my complaints attended to, and the evils remedied. Some elevator wells are not closed in but on each floor are railed in, and some openings are protected by doors in the floor that are operated automatically. Some elevator cars, or platforms, are similar to those in use on the old-fashioned hand hoist. It would prevent some accidents if such were closed in by close boarding, say six feet high, and have half-doors opening inwards, in front, then people could not have their feet or any part of the body projecting over. The cable lock I mentioned is effected by having the shipper cable pass through a small iron ring held by a standard about three feet high. In this ring is a thumb screw which, by turning bears on the cable, prevents it from being moved.

I beg to acknowledge the receipt of—from Dr. Thos. Oliver, M. D., F.R.C.P., Physician to the Royal Infirmary, Newcastle-upon-Tyne,—a copy of his report upon "The pottery industry of France," dealing with "the manufacture of porcelain, such as is seen at Sevres and Limoges; and ordinary ware made at Montereau which resembles that produced in Staffordshire."

I have the honor to be,

Your most obedient servant,

ROBERT BARBER,

Inspector of Factories.

Toronto, February 1st, 1900.

CENTRAL DISTRICT.

To The Honorable the Minister of Agriculture of Ontario.

SIR,—I have the honor to submit the following report on Factories Inspection for the year 1899 :

The improvement in business noted in last year's report still continues ; so much so that many complaints have been made by workers against their being required to work overtime, the complainants stating that ten hours a day was even more than they felt able to work, with justice to themselves. It is to be regretted that, whether from longer hours being worked and an increased number employed, or from machinery being speeded up to turn out the greatest amount of work, a great increase in the number of accidents has resulted.

AGE OF CHILDREN.

There are always doubtful cases of the ages of children, whose ages cannot be verified because of the neglect on the part of the parents to register their children's births. I can only recommend what I have frequently done heretofore, that a certificate from the teacher of the school which children have attended should be required as to their age before boys or girls are allowed to work in a factory, as the teacher is more likely to be informed of the correct age of the children than would be an employer. One cannot help but feel keenly when widowed mothers request to have their children permitted to work in a factory, although not of legal age to do so. One case in particular I might mention. While visiting a factory the employer told me of a boy who was under age, and whom he had permitted to remain until he could see me personally. He asked me to accompany him to the mother of the boy who worked in the factory also. On seeing the mother I stated to her that it was against the law to have her boy employed in a factory under fourteen years of age. Her eyes filled with tears. She stated that she had three children to provide for ; that owing to her working in the factory she could not control him ; that he was getting into bad company ; and if he were sent out she did not know what would become of him, as he would not attend school. On enquiry I ascertained that he was employed sorting rivets, and that he sat on a stool to do the work, away from any machinery. As he was only some months under age I assumed the responsibility of allowing him to remain for the time being.

OVERTIME.

Twenty-three permits for overtime were granted. But, as already indicated, complaints were made by some of the workers against their being required to work overtime. And when it is considered that recreation is necessary and the amenities of life deserve some consideration, it is not to be wondered at that objection should be made to long hours of work. Considering the enormously increased productive power of labor, it is not unreasonable to expect that the hours of labor should be reduced rather than increased. Industry should be rewarded by rather more than a bare existence.

COMPLAINTS.

All cases of complaints concerning infractions of the Act have been investigated, and, where necessary remedied ; but many complaints have been made

by workmen who evidently have a misconception of the scope of the Act. I have been requested by a workman to see his landlord and get him to put the house in which the workman lived in a sanitary condition. He seemed surprised when I told him that it was a matter for the health authorities to attend to, and that the Factories Act did not deal with unsanitary conditions of the houses of workers. Time and again I have been requested by men to have the hours of labor shortened, and to get an increase of wages for them. In one case, when I stated that the Act only dealt with matters affecting the health and safety of the workers, I was met by the reply that heat was necessary to the health, and that working in a cold shop was injurious to the health, and that a sufficiency of good food, clothing, and comforts were necessary to health, which could not be obtained without good wages, and that the Government should see to the wages paid in factories as to whether things necessary to the health of the operatives could be procured. I suggested that what was proposed would be an interference with the trade and commerce of the country and would be a matter for the Dominion Government to deal with. I may say that in only one case of complaint sent in by labor organizations was the complaint without foundation; and as I was afterwards informed, the party who made it had not been informed that the cause of complaint had been remedied.

VENTILATION.

Complaint having been made that in some factories where only one polishing or buffing wheel was in operation, no fans for the removal of dust were installed, and that the workers suffered in health in consequence of the want of fans, as the inspectors had not insisted on a fan under such conditions heretofore. Dr. Bryce was requested to report as to the necessity for fans in such factories. He recommended that as metallic dust was generated while the polishing was in operation, which was injurious to health, the dust should be removed as generated by ventilating fans in the factories where such are required; which recommendation will be acted on.

ACCIDENTS.

The number of accidents reported and ascertained as having occurred during the year are one hundred and forty-six, eleven of which were fatal. Of the whole number, nineteen were caused by circular saws, five of which were fatal. Ten were caused by belts, four of which were fatal. Fifteen by power or other presses, and seven by gear.

John Wilson died from injuries received on a hoist. The pulleys of the hoist being defective, the hoist occasionally became jammed at the openings in the various floors. It is supposed that the deceased, on such having occurred, had jumped on the hoist with a view to release it; that the hoisting rope having unwound, leaving considerable slack, which when the hoist was released, allowed it to drop to the basement of the mill, when the deceased received the injuries which resulted fatally. The noise of the fall attracted the attention of some of the operatives, who found the hoist ascending, with the head of deceased projecting over the edge of the hoist, which was stopped just below the first floor, when the deceased was with difficulty released. New pulleys had been provided and were to have been put in use on the day the accident occurred; the hour at which it occurred was 4 a.m. The mill runs night and day with two sets of employees.

John A. McMillan had permission to leave the mill shortly before it would close on Saturday night; to save time, it is supposed he attempted to cross the shafting in the lower part of the mill, with the result that he was found with his body lying over the shaft, head at one side and feet at other side, left leg broken in two places, cut on right side of the body, and lungs injured. He died 18 hours after the accident.

Of the other nine fatal accidents five were caused by circular saws, two of which were caused by a piece of wood thrown from saws, and one by falling on a saw. He was working in a "tie" mill, three being employed in it. The other two employees had gone out of the mill, leaving the saw running. The deceased was seen by a driver of a cart, with an oil can in his hand, close to the saw carriage, which was stationary. The driver moved away; hearing a noise, he looked towards the saw, when he saw deceased cut in two; the carriage had been moved close to the saw. It is supposed that he had moved the lever operating the carriage while in front of it, and, moving back to get out of its way, had forgotten that the saw was behind him, and fell on the saw. One fatal accident occurred by a man crawling under the saw-table for some purpose. Piping connected with an exhaust fan removed the sawdust from under the table, which was operating satisfactorily, so that there could be no necessity for him being under the table. Another fatal accident happened by shoving a slab through the rolls at a splitter. The man had his hand caught and was drawn through the rolls and cut by the saw. He was under the influence of liquor, and had been ordered away by the man operating the adjoining splitter. His work was to cart slabs from one mill to another, and he was not required to do anything else. Of the four fatal accidents caused by belts, one was to a man working on a platform which he had erected, which collapsed, throwing him against a belt, and he was carried around a shaft and fatally injured. One, while shifting belt on a pulley, was entangled therein and carried around a shaft, and fatally injured. One, supposed to have thrown belt off a pulley with his hand, on which he had a mitt, and got caught in the belt and carried around a shaft until the belt broke; the body was lifeless when found. And one, after having thrown a belt off a pulley, put his foot on the belt, which was still moving; the shaft was close to the floor; the belt formed a loop which caught his leg, drawing him around the shaft, causing instant death.

It is cause for regret that there should have been so many accidents. The increase in the number employed, the long hours worked, as also more accidents being reported (as alluded to in last report), doubtless accounts for the increase to a great extent. And when it is considered that many undertake to operate machines without a realization of the attendant danger, or, where it is realized, many are tempted to take liberties with machines which they ought not to do, with a view to increasing wages, it is not surprising that as a result they are maimed or killed.

A statement in a recent number of *The Scientific American* would appear in a measure to account for many accidents. Quoting from a paper dealing with the methods employed by manufacturers in Europe and in the United States, the writer of the paper referred to says of the American manufacturers: "They proceed on the principle that time is money, and therefore they spend money freely to save time. They do not hesitate to buy the most improved machines to replace their existing plant from time to time, and they speed up their machines so as to turn out the greatest possible amount of work, and employ the best men that money can buy to operate them." The speeding up the machines necessitates a greater strain on those operating them, and increases the liability to accidents. The above reference to American manufacturers may be applied to Canadian manufacturers as well.

In some industries, under the keen competition existing, operators must turn out a certain amount of work, which perhaps cannot be done without taking undue risks. A worker recently remarked that in order to obtain a living men had to risk life and limb operating dangerous machines, requiring a mental strain for long hours and a quick manipulation, if decent wages were to be earned. And the worst of it was that there was no provision for those maimed, or for their families in the event of death; at the same time drawing a comparison

between the "absent-minded beggars ordered south," whose families would at least obtain some little indemnity, and rightly so, in the event of the loss of a husband or father, as might be the case. I told him that I could remember the time when soldiers' wives and families were left to shift for themselves, and that in time to come we might expect that provision would be made for the widows and orphans of workers whose lives had been sacrificed "in order to turn out the greatest possible amount of work." Peace has its "butcher bill" as well as war. The increased productive power has its analogy in the increased destructive power in warfare.

EXPLOSIONS.

One accident whereby an employee was scalded by the "bursting" of two "T" pipes leading from the boilers to the engine. Thinness of metal in the "T" was given as the cause of the explosion. No boiler explosions have occurred in the conral district during the year. I can only urge, what I have already done, in reference to boiler inspection. It is in the smaller industries whe defective boiler are most likely to be in use, and where necessarily the greatest danger lies in regard to boilers. Unless legislation would include all such as are used for generating power, such legislation, I believe would fail in its object of providing for the safety of employees. I would again state that I am of opinion that the owners of all boilers, as may be defined under any Act which may become law, should be required to have said boilers inspected at least once in each year; said owners to be held accountable that the person so inspecting the boilers shall be competent to do so. By allowing owners to have their boilers so inspected they could select such times as would be most convenient for them. A certificate of the inspection of the boiler and date of inspection might require to be kept, subject to its being required to be produced by anyone authorized to require its production.

FIRE ESCAPES.

A recent action for compensation for injuries received, by a young woman who was compelled to jump from the third story of a burning building, occupied as a factory, the exit by the stairs having been cut off, emphasizes the necessity of employers providing fire escapes. Section 21, sub-sec. 3 of the Factories Act reads :

"Every factory three or more stories in height in which persons are employed above the second story, unless supplied with sufficient number of tower stairways with iron doors, shall be provided with a sufficient number of fire escapes; such fire escape shall consist of an iron stairway with a suitable railing, and shall be connected with the interior of the building by iron doors or windows, with iron shutters, and shall have suitable landings at every story above the first, including the attic, if the attic is occupied as a work-room, and such fire escapes shall be kept in good repair and free from any obstruction or incumbrance of any kind; but any of the requirements of this sub-section may be dispensed with in any factory if the inspector so directs."

So that a fire escape is required to be provided unless the Inspector directs otherwise. The case above referred to was settled at the suggestion of the Court on payment of the sum of \$650 and costs. In the smaller industries, where buildings are rented for factories, the employers would require to be careful about renting premises for a factory above the second story, unless a fire escape was provided by the landlord. In New York State either the landlord or employer can be held responsible, it being considered that where a building is rented for a factory the owner should be required to have the building in accordance with the requirements of the Factory Act of the State.

BAKE SHOPS.

A few complaints have been made with regard to bake shops. One or two complaints against the employees working more than ten hours a day have been made, with the request that the complainants be not called upon to give evidence in the

event of prosecution. Some employers are not as careful as they might be in the matter of lime-washing. I have pointed out to such parties that a prosecution would likely result in a loss of business, as the public would be apt to think that if they were careless in regard to one requirement they would be likewise careless in others.

OVERTIME PERMITS.

Twenty-three permits for overtime have been granted during the year. In one case several nights' overtime had been worked without a permit, and when a permit was applied for, it was expected that the thirty-six nights would be allowed; but I notified the firm that the nights which they had worked before the permit was applied for would be taken into account and deducted from the thirty-six which is the full limit allowed by the Act.

Appended herewith is a list of accidents for the year.

I have the honor to be, Sir,

Yours very respectfully,

JAMES R. BROWN,

Inspector of Factories.

EASTERN DISTRICT.

To the Honorable the Minister of Agriculture for Ontario :

SIR,—I beg most respectfully to submit my report of inspection for the year 1899.

The best proof of the necessity and beneficial effect of the Act to protect persons employed in the factories is the fact that every year we notice considerable improvements in all matters concerning the welfare of the employees, and a much better disposition on the part of the employers to not only comply with the Act but to assist the Inspector in all his suggestions for the benefit of the employee as well as to prevent the employment of young children.

There are, however, some minor establishments where the managers do not seem to understand the importance of the law, and consider the question of protection to and the welfare of the young secondary to the question of cheap labor. In saw mills, also, I again noticed, notwithstanding my repeated admonishments, that young children are employed in shingle and lath-making. I have experienced considerable difficulty in securing sufficient information to permit me to prosecute with sufficient certainty of success, but I have, on several occasions, and in the majority of localities, secured the assistance of some persons who, understanding the benefits to be derived by children and the working population generally by the enforcement of the provisions of the Factories Act in this respect, have consented to give me during the year sufficient information to permit me to detect and punish any violation. Another cause of complaint I have observed also is the removal of guards to dangerous machinery, and the neglect to replace them when removed for repairs. At the time of inspection it is impossible to find in those cases sufficient ground for prosecution for neglect, as we are told that it was just removed for repairs; but I have also succeeded in several places in securing the assistance of persons interested, and a few prosecutions and severe punishment will have a general good effect. The neglect to replace some of these guards is dangerous in some cases, and I know of one instance where an accident occurred which might have been very serious and perhaps fatal. In this case I was told by the victim that he was only trying the edging saws after repairs before replacing the guards, when I feel convinced that only for the acci-

dent these guards may have never been replaced during the season. I must say however, that whilst there is a small increase of accidents in my district, the number is yet so much lower than previous to the operation of the Act that we must admit the necessity of and benefit derived to workmen by its maintenance and being strictly enforced in its main features.

There exists another evil which, I must say, has considerably diminished since I drew the attention of managers and overseers in factories thereto. It is the manner in which young girls working about machinery carry their hair. Although the employees are now beginning to notice the danger arising from this cause, and are giving the matter considerable attention, there are still many who refuse to protect themselves and pay little or no attention to the advice given to them, that I feel that it will become necessary to amend the Act so as to at least regulate the manner in which all young girls and women who run machinery of dangerous character should wear their hair and clothes. We have the experience of several serious accidents of scalping and broken limbs to justify such a measure. In France all female employees who work around machinery are compelled to wear their hair in a net.

The danger of corrupting the morals of the young by contact with the grown-up employees of both sexes has apparently somewhat abated, and the managers and overseers to whom the young are confided seem to have understood my apprehensions in that respect, and to have watched and exercised a more paternal supervision over the young under their control, and I feel convinced that before long this danger, which has already diminished, will have almost disappeared.

There exists still a danger to which I referred in some of my previous reports. It is only necessary to enter some of the large factories to observe the seriousness and extent of accidents which may be caused by the want of an alarm to give warning to employees throughout the establishment of the connection of the power with the machinery. In these reports I have mentioned some serious and even fatal accidents resulting from the neglect or failure to give such warning; and even lately I have learned of other serious accidents due to the same cause. It is true that they are not of very recent dates, but what has occurred before may be repeated under similar circumstances, and I hope that as soon as the Government will revise the *Factories Act* they will take into consideration the advisability of making such amendments as will remove this danger.

I have observed this year that small mills, which do not come under the jurisdiction of the Act owing to the limited number of persons employed therein, are often more dangerous, and accidents are more liable to occur there than in larger establishments, as less attention is paid to the safety of the employees than to the penurious economy to perform the labor; in some instances also, for the purpose of saving the employment of persons, the machinery is so crowded as to render it dangerous to those working around it. I can only repeat what I have said in some of my previous reports, that it will become necessary to so amend the Act as to extend its operation to all mills or factories where machinery is worked by power of any kind in order to give the Inspector full authority to supervise them for the protection of the employed and also to prevent the employment of young children, as is often the case in these small saw mills. I have received complaints about Sunday work in bakery shops, and also demands of permits for such work from employers. This is certainly a difficult question to solve, as in most of these places Sunday work becomes a necessity in order to be able to deliver the bread for Monday morning. This matter, I consider, is surrounded with some difficulties, as to prevent any work on Sunday would necessitate the employment of extra hands on Monday, which is not always easy to secure in skilled labor, and I believe that the bakers may be allowed as a general rule to make their sponge on Sunday so as to prepare work for their hands for Monday morning and be able to supply their customers with bread.

ELEVATORS.

Elevators in all factories, with one or two exceptions, are provided with the necessary safety catches, and it is pleasing to note that since this clause of the Act has been rigidly enforced no accidents have been reported, and I believe none have occurred through this cause.

FIRE ESCAPES.

It is gratifying to be able to report that all factories are sufficiently provided with means of escape in case of fire. It is a fact, however, that in some cases the fire escapes are rendered useless in the winter season by the blocking and freezing of the windows opening on to the balconies of these fire escapes placed alongside the walls outside. I consider that, instead of windows leading to these balconies, there should be an iron door reaching the floor and the employees permitted to use occasionally these fire escapes so as to give them some experience with them in case of necessity.

HEATING AND VENTILATION.

In all places the heating is quite sufficient for the comfort of the employed, but in several instances in the winter season the ventilation is not sufficient where a large number of persons are located in the one room—there being no other means of ventilating than by the windows and they are kept closed entirely during the cold weather. In several large factories, however, they have now arranged one or two windows in a large room so that they can be opened during dinner time and morning and night.

A great cause of annoyance to the inspectors is the question of age certificate. As usual the employer, in order to relieve himself of responsibility of the Act, obtains a certificate of age from the parents or guardians of children seeking employment without any consideration whether this certificate is true or false, and I must say that the parents give the certificate regardless of the truth. In other cases certificates are brought by the children made and signed by themselves, as in most instances the parents are unable to read or write. I consider that, in order to obviate this trouble, it would be well that when young children seek employment the parents be obliged to accompany the child to the office and there and then make a written declaration of the address or residence of child and his age, in the presence of some responsible person in the office who would witness the same; blank forms of these declarations to be furnished to the employers by the inspectors.

The difficulties which surround the Inspector in making inspections very often prevent him from detecting all violations of the Act. I have attempted every year to secure the assistance of parties who might have some interest in having the Factories Act carried out as far as protection to machinery is concerned but I could never succeed, although I know in some cases the very persons requested to lend their assistance would be amongst the first to complain about the violation of the Act by these employers. It is also in vain that I have sought the co-operation of the labor unions, the leading members of which are so loud in preaching that these unions have been established for the welfare of the working people. All information of gross violation of the Act in mills or factories could be communicated through some executive board of these unions that would be charged to look after the welfare of their fellow workmen, and in that manner remove all fear that private information would be divulged and expose the employees to dismissal. I must say, however, that I have received this year assurances of better assistance for next year, and I hope it will have a very beneficial effect.

There seems to be an increased activity in the manufacturing business, as all mills were working to their full capacity, and in some instances permits were asked for and accorded to work overtime. These were in the Dominion Cotton Mills at Kingston, the Canadian Cotton Mills at Cornwall, and the Woollen Manufacturing Company at Cornwall; and it is believed, judging from the appearances, that this increase will continue steadily at least some time yet.

ACCIDENTS.

The accidents have been somewhat more numerous this year than for some years past, but of the fourteen reported none, according to report and information, have occurred through defective machinery or for want of being properly protected.

Of these, one was fatal—H. Filion, 37 years of age, losing his life by hemorrhage from a wound received on his leg in the breaking down of a scaffold on which he was working at the Riordan Paper Mills in Hawkesbury, on the 3rd day of March, 1899.

One necessitated the amputation of one foot, which got caught in a shaft at the W. C. Edwards Co. Mills, Rockland.

One caused the loss of the right arm, below the shoulder, of Norton Olds, by the revolving knives of a self-feed planer in the factory of the J. W. Mann Co., of Brockville, while engaged in removing a piece of wood stuck in the framework of the planer.

One caused the amputation of one finger on the right hand of William Hughes, which got caught in roller of carding engine.

Four of these accidents caused injury to the extent of broken limbs.

I. Byron, on the 21st of September, and C. Stahlsmith, on the 1st November, had their legs broken by boiler in the Canadian Locomotive and Engine Co. Works, Limited, at Kingston.

Alvin Upper had his leg broken below the knee by the fall of a bale of cotton in the Stormont branch of the Canadian Colored Cotton Mills at Cornwall, on the 11th day of October; and on the 4th December George Nicholson had his leg broken by the bursting of a steam jacketed tank in the James Smart Mfg. Co. Works at Brockville.

The other six accidents were of a less serious character, and are as follows:

H. Pulford, hurt by a fall in a pulp pit at the Riordan Paper Mills at Hawkesbury, on the 7th of November.

D. Leroux, hurt by falling with a broken scaffold on the 1st day of March.

James Kehoe had his back injured by falling with a scaffold, broken down by the fall on it of a shaft, at the Napanee Cement Works.

Willie Wilson had his right arm caught in machinery and the flesh was torn, on the 28th of April, in the Dominion Cotton Mills at Kingston.

William Freeman had his foot bruised between the floor and an elevator in getting off before it was stopped, on the 29th of November, in the Canada branch of the Canadian Colored Cotton Mills at Cornwall. And in the same factory, on the 5th of December, Adelard Bourget received a flesh wound on the arm by the gears of a rope-making hand-power machine.

All of which is respectfully submitted.

O. A. ROCQUE,

Inspector of Factories.

REPORT OF FEMALE INSPECTOR OF FACTORIES.

To the Honorable the Minister of Agriculture :

SIR,—I have the honor to submit the following report of work done during the past year in Ontario.

The close of the year 1899 brings with it the duty of reviewing the work accomplished and giving a report to you of same. I may say it will differ very little from preceding ones, being for the most part, a statement of the different laws to be enforced.

Much of the work of the inspector does not appear on the surface. Complaints and other troubles which many times call for mediation rather than law, make a large demand upon our time. It has been impossible for me to inspect often all work-shops and factories during the year, but my time has been devoted to those places which require the most careful attention. Only a limited number of factories can be visited more than once a year. Experience has shown that where we are able to revisit factories occasionally orders are more promptly complied with, and generally, factories are in a better condition than where only a yearly inspection can be made. I had anticipated each year that the work would decrease, but I find it has not done so. As new factories come into existence, which they have done very rapidly this year, others are undergoing changes and moving, and at the same time the manufacturers are becoming more familiar with the law and realize its aims and objects, therefore, more calls for the Inspector and more time is consumed.

TRADE.

Last year, when making my report to you, I was able to say that there had been a revival of business, and that there were good prospects of the long period of commercial depression under which the country had suffered coming to an end. The experience of the last year has amply confirmed the expectation. There has been, during last twelve months, a decided improvement in nearly every branch of manufacturing industry, and the year 1900 has opened with a brighter prospect than has been promised to us during the last ten years.

COMPLAINTS.

There is not a single item in all the many transactions in connection with our work which occasions so much loss of valuable time as the matter of complaints. I receive very many complaints, some not giving specific or correct information : others make their charges general, implicating every person in the locality engaged in the particular calling or trade against which they are making complaint. Those complainants should not find fault with the non-enforcement of the laws, but if they have any facts give the officers a chance to know just what they are. Some things we can find out, and others we have no means of so doing. I do not mean to say that all complaints are such as the above named. Many have reached me which, after investigation, I have found to be fully justified, and these have received immediate attention. Many complaints have been made to me of inconveniences of girls in offices, but having no power over such places, no material assistance could be rendered. I consider this a grievance, as there should be proper sanitary arrangements in all buildings where females are employed.

CHILD LABOR.

The law regarding child labor has been rigidly enforced. Registers and statements for children employees have been carefully examined. As a rule, manufacturers are willing to comply with the law relating to child labor. Ignorance of the law is sometimes pleaded, but such excuses have but little weight when we have taken great pains to furnish them with copies of the law. Apparently many people suppose that the factory laws reach all places where children are employed. Many children are employed in places other than factories.

In the practical operation of the law relating to child labor, occasional instances of hardship have been discovered, such as the loss to a widowed mother of the small amount which her child might earn. It has been repeatedly stated that some discretion should be allowed the inspectors which would enable them to annul the law in exceptional cases, such as the one supposed. A vast amount of theorizing has been indulged in, in the attempt to show that such laws are unwarranted interference with the rights of parents to control the time and receive the earnings of their children. The welfare of the child cannot be sacrificed to the short-sighted demands of parents, who, for their own apparent benefit, would doom their children to a life of toil and ignorance. My view of the duty, as it regards the enforcement of this, or any other law, is, that while good judgment and discretion ought always to be employed, the whole fabric of legal protection to child labor would be undermined if the enforcement of these laws were left to discretion of the Inspector. Taking the larger view of the subject, individual cases of hardship must be dealt with as they occur; meanwhile there must be no weakening of the law. The high standing existing here must be maintained, not only for the sake of our own child-workers but because Ontario is leading in industrial reform, to which other provinces are turning for enlightenment and guidance.

Of all improvements coming under my observation, not one meets my approbation more heartily than the steady decrease in the employment of child labor. The strict enforcement of the law applied to children in the factory has a most wholesome effect, to the extent at least that manufacturers are compelled to look elsewhere for help whose presence would not cause them so much trouble.

CONTRACT-MAKING OF CLOTHING.

A great improvement of the conditions under which this work was formerly done is noted this year. Limiting the hours of labor of women caused some dissatisfaction in the custom branch of this trade, one reason being the shortness of the busy season. We find in the larger shops a number of independent masters, caused by the renting of small portions of the shop to persons having seat room, the practice being for one party to hire a large room, then sub-let in small portions to others who make their own contracts and hire their own help, thus dividing the responsibility for violations of the law.

The fashion in vogue among women of wearing so called tailor-made garments has introduced into the dressmaking business a large number of men tailors. Those men are able to produce a more stylish garment at a greatly reduced labor cost, and are in consequence driving women out of this business. One of the results of this condition of affairs is that the standard of cleanliness in these shops is far below that to be found in the dressmaking trade.

Some of the shops of the contractors who work for the wholesale trade are located in buildings entirely unfit for occupation,—rooms poorly ventilated, walls and ceilings dark, floors old and dirty. In places where I have found such a state of affairs as above mentioned I have always endeavored to compel the proprietors of the workshops to keep the floors and waterclosets clean, and to have rooms ventilated, and to place disinfectants wherever I have thought necessary. I have

also measured some of those workshops to ascertain if each individual had sufficient cubic air space.

Ready-made clothing establishments, while not always in as good condition as could be desired, are improving gradually. Many of those contractors have secured better and cleaner shops. One great difficulty is that there is a continual changing of owners of these places—a moving around from place to place, which makes the inspection of those places a difficult task. The enforcement of the law in relation to sanitary appliances and their proper maintenance is very difficult; a good deal owing to the carelessness of people employed therein. The law regulating the hours of labor for women will require close attention as the supply of labor in the ready-made clothing is not at present equal to the demand, and the temptation to violate its provisions is therefore apparent.

SANITARY.

The improvement of the sanitary condition of factories has received the attention which the importance of the subject demands, and I have no hesitation in saying that the sanitary condition of the large majority of manufacturing establishments and mercantile houses in Ontario can maintain a record second to none. But in the crowded part of the cities, where old buildings are converted into workshops, the closets are frequently insufficient in number, and in the tailor shops their condition has been a constant source of irritation to me. No matter how many times the owners are obliged to clean them, upon the next visit of the inspector they are found in the same dirty condition. The standard of cleanliness and pure air is not as high as it might be in our small factories and workshops. There is dirt, which may be said to be clean dirt, since it is incidental to work and not of long standing, but generally speaking, dirt means disease. This low standard is not the fault of employers alone, employees often misuse the best provisions made for their comfort and welfare. The law does all it can, but it can never be wholly efficient unless it has the support of those for whom it was enacted. I know that the majority of manufacturers realize all the benefits derived from factory laws, that their establishments are in better condition as regards cleanliness, ventilation and safety; that the employees are better mentally, morally and physically; that the whole social atmosphere of factories has been improved and will continue to improve. Occasionally an employer is found who has not learned what the majority of employers already know—that the labor laws are not an unwarranted meddling in their affairs, but are mutually beneficial to manufacturers and their employees, who have rights that must be respected. There is nothing so commendable as, or more necessary about a factory than, cleanliness. The employer does not exist who through choice would not prefer an employee who is neat in work and person. Yet we frequently find no provision whatever made for the cleanliness of their employees. It should be considered an absolute necessity in the construction of a factory to provide a place available to each floor with proper facilities for washing and dressing, whereby no employee need be compelled to leave the establishment in an untidy condition. There can be no more profitable expenditure of money, or consideration given the employees that will be more fully appreciated. Many mercantile houses and manufacturing establishments have furnished clean work-rooms, good ventilation, well appointed water closets and go far beyond requirements of the law in providing as convenient dressing rooms and dining-rooms as can be found in private houses.

Wherever in the course of inspection I have found unsanitary conditions, which came within the jurisdiction of local medical health officers, I have found them prompt and efficient in giving attention to reports made to them, and just here I would like to thank them for the valuable assistance given me in the discharge of my duties.

VENTILATION.

Much improvement has been made in the ventilation of old buildings during this year, and the new buildings are being provided with the modern means of heating and ventilating. There appears to be a steady and healthy growth of public sentiment in favor of providing good ventilation. It is only in somewhat recent years that attention has been fully directed to the great necessity of scientific ventilating in factories, in such such places where women and children, as well as men, are employed many hours weekly.

The dust from fabrics and raw material stirred up by the operations of machinery, the high temperature in which some work must be done, are important considerations that bear upon the health and comfort of all operators. The subject is one of importance, and we can well afford to devote a few lines thereto. No heating of a room can be said to be made complete unless provision is made for supplying it with pure air. Heating and ventilating should go together. We may ventilate our rooms, but they will be rendered cold in the act. We may warm our rooms and the air will become vitiated in the process of shutting out the cold and keeping in the heat. The two matters must be harmonized, and there lies the difficulty. Without going into the merits of the many methods now applied for ventilation, I would say it is of the greatest importance that in occupied rooms the impurities which have been gathered should have some direct means of removal by mechanical means, or, in other words, by applying power to affect the change of air by the exhaustion of the foul air and the supplying of fresh air under the changes of wind and weather. There is yet room for improvement along this line. That foul air and unclean surroundings are injurious to health are facts familiar to the common mind. That public health is liable to be seriously impaired by the unsanitary condition of a single dwelling-house any intelligent community fully understands.

The ordinary work-room and small factory are seldom supplied with any means of ventilation except windows and doors, and these are, of course, closed in cold weather, and the work-people are occupied day after day in rooms where there is no change of air except as a window or door is opened. Much ill health, not pronounced enough to drive the worker entirely out of the work-shop but sufficient to drag life down to daily misery and to make work burdensome, is caused by badly-ventilated work-rooms. It is to be hoped that in a short time every work-shop will be so ventilated as not to threaten the most essential condition of good work, that is, good health.

HOURS.

The factories which work the full sixty hours per week are principally cotton, woollen and knitting factories, commencing at 6.30, a. m., and stopping at 6 p. m., with one hour for dinner, thus making $10\frac{1}{2}$ hours per day, in order have a shorter day on Saturday. Some factories try to cut short the noon-day meal hour of every day in the week. The only practical remedy is to make Saturday half holiday a lawful right without interfering with the lawful privileges they enjoy during the week. The hours of employment for females are shorter in cities in almost every industry. A very large percentage of workers leave work at twelve o'clock on Saturday, beginning at 7.30 and 8 o'clock, having one hour at noon, quitting at 5.30 and 6 o'clock, thus making from 45 to 55 hours per week.

OVERTIME.

I have been struck by the frequently-expressed opinion of employers, as well as of employees, that over-time is injurious alike to the best interests of both. I share this view very strongly myself, and am convinced that the amount of over-

time sanctioned under the Act is in excess of the necessities and even of the desire of those who have the best claim for consideration on this question of over-time. Many women have expressed a wish that the number of days in which overtime was allowed could be decreased. I find workers keeping a private record of their own time, and how eagerly they look forward to the completion of the thirty-six nights of over-time allowed in the year.

SHOPS.

In many respects the women employed in mercantile houses are under a more wearisome strain than those employed in factories and work-shops. There is double exaction from employer and customer, more cramped and confined position, less freedom of movement.

The amended Shop Act, requiring the general inspection of all mercantile establishments, was a most commendable and wise enactment, and has opened an avenue through which unbounded benefits have come to this great army known as "shop-girls," and has relieved them from many inconveniences. The law calling for those establishments to provide seats for women, and allowing their use when not necessarily engaged in the active duties for which they were employed is a wise one. This section is very generally complied with.

We have a section in the Factories Act calling for a report of all accidents, and I think we should have a section in the Shop Act that mercantile establishments should report accidents in like manner, "Whenever the accident results in the death of said employee, or causes bodily injury of such a nature as to prevent the person injured from returning to work within six days after the occurrence of the accident."

We have no way of knowing when an accident occurs unless some of the operators in the factory be injured, and I am sorry to have to state here that in the most of cases in the large departmental stores the workers are not allowed to use the elevators. They have to go up from four to six flights of stairs.

Elevators are a source of many and serious fatal accidents, and the remedy seems to me to be a more stringent legislative enactment to the effect that none but capable persons be allowed to take charge of elevators where so many thousands of people are ascending and descending from day to day. Extreme watchfulness should be exercised on the part of those upon whom the responsibility rests. The sacrificing of human life, the crippling and maiming of human beings should not be lightly overlooked.

The placing of all industries, regardless of the number employed, under inspection laws has opened the doors of many places where it is high time relief should be given.

NEW FACTORIES.

Section 28 of the Factories Act reads :

"Every person shall, within one month after he begins to occupy a factory, serve on the inspector a written notice containing the name of the factory, the place where it is situated, the address to which he desires his letters to be addressed, the nature of the work, the nature and amount of the moving power therein, and the name of the firm under which the business of the factory is to be carried on, and in default shall be liable to a fine not exceeding thirty dollars."

This section of the law is not complied with. The locating of these new industries takes up a great deal of time. I think the time has now come when all such violaters should be prosecuted.

NIGHT WORK.

There is a custom, and it seems to be growing, that of employing women at night to work in our paper mills and knitting factories. I think it is wrong for women to be compelled to work at unseasonable hours—that is, starting at 6 p.m. and working till 6 a.m.

Other States have given this matter consideration. There is a section in the law of Massachusetts which reads:—

“No corporation or manufacturing establishment shall employ any woman or minor in any capacity for the purpose of manufacturing, between the hours of ten o'clock at night and six o'clock in the morning.”

It would seem that there could be no division of opinion as to the necessity of such a law, and it is in the exact line with all the other enactments in respect to the labor of women and children.

ABSTRACT.

I have endeavored to keep posted abstracts with my address, and time tables regarding the hours for women. In this respect the law is generally complied with.

No one can go through our large factories and workshops without being convinced that there is nothing in the situation itself that threatens the working woman if she is fitted to be her own protector. There, as everywhere, character tells, and the self-respecting and well-behaved woman is her own best guardian, but the majority of women-workers are young, often in their teens, and need what youth needs everywhere, guidance, oversight and wise restraint. An excellent custom, found especially in book binderies, printing offices, and candy factories, is the putting all the young girls under women overseers. I should like to see the same rule applied in all establishments.

In conclusion, I would say that there has been but little friction in carrying out the spirit and letter of the various laws to be enforced.

Courteous and respectful treatment has been accorded me wherever my duties have required me to visit. Every facility has been afforded me in the performance of my duty.

I have the honor to be,

Yours respectfully,

MARGARET CARLYLE,

Factories and Shop Inspector.

APPENDIX.

ACCIDENTS REPORTED IN 1899.

No.	Date.	Employer.	Place.	Business.	Person injured.	Age.	Particulars.
1	January 3	Brantford Starch Co. (Ltd.)	Brantford	Starch	Arthur Dennis	.....	Right leg hurt by a revolving shaft; not serious.
2	" 13	London & Petrolea Barrel Co.	London	Barrels	Andrew Elow	.....	Left arm cut off by saw; reaching under table.
3	" 20	Goderich Organ Co.	Goderich	Organs	Jas. Robertson	.....	Two middle fingers cut by saw; amputated.
4	" 23	The Wm. Grey & Sons Co. (Ltd.)	Chatham	Carriages	Saml. Towl	.....	Right thumb cut off by circular saw.
5	" 27	The Anderson Furniture Co (Ltd)	Woodstock	Furniture	Benj. Hobson	35	Right hand injured by swing saw.
6	" 26	London Hinge & Bolt Works.	London	Hinges and bolts	Chas. Duncan	28	First finger right hand injured in a bolt header, adjusting die.
7	" 27	Massey-Harris Co. (Ltd.)	Brantford	Reapers, etc.	Chas. Markel	.....	Left little finger crushed in gear of small drill.
8	" 28	"	"	"	Wm. Easton	28	Three fingers cut, two off, by circular saw.
9	February 19	"	Toronto	"	Man	.....	Arm burned by molten iron; he stumbled.
10	March 25	"	"	"	F. Gilbert	.....	Right foot burned by careless handling molten iron.
11	" 29	"	"	"	Geo. Facon	21	Right arm hurt; fell on disc barrow.
12	February 26	"	"	"	Geo. Masters	.....	Toes injured; rolling in gritstone; fell on him.
13	April 4	"	"	"	P. H. Wreggill	.....	Hand cut in screw machine.
14	" 13	"	"	"	H. Whitaker	.....	Finger hurt by drop-hammer falling on it.
15	" 18	"	"	"	Jno. Virtue	.....	Shoulder blade broken; clothing caught in set-screw of drill.
16	May 22	"	"	"	Reuben Hunt	.....	Hand jammed in wheel of hand saw.
17	June 8	"	"	"	R. Moxon	.....	Abdomen struck by piece of flying emery wheel.
18	" 12	"	"	"	W. Ward	.....	Leg and hand bruised by elevator platform.
19	" 30	"	"	"	Jno. McCleary	.....	Foot jammed by elevator platform.
20	September 22	"	"	"	Jno. Nicholson	.....	Hand cut and hurt by falling on some barrows.
21	November 20	"	"	"	W. McLean	15	Leg cut; stepping on iron, it flew up and cut him.
22	December 7	"	"	"	Jas. Magill	.....	Hip and back hurt, ladder slipped; he fell across a barrel.
23	" 26	"	"	"	W. Ball	.....	Two fingers crushed by elevator weight falling.
24	January 16	Reeves Pulley Co.	"	Pulleys	Fred Hale	30	Two middle fingers cut by jointer.
25	December 7	"	"	"	John Hull	19	Finger, first, taken off by a buzz planer.
26	" 26	Jno. B. Snider	Waterloo	Furniture	Wm. Bohlender	32	First finger, left hand, cut by shaper.
27	September 12	"	"	"	Hy. Ziegler	33	Hand cut and two fingers amputated by saw.
28	January 28	Verity Plow Co. (Ltd.)	Brantford	Plows	Saml. Westway	57	Fatal, by collapse of drying kiln over boiler-press.
29	November 22	"	"	"	Jas. Sears	47	Tops of two fingers taken off in stamping press.
30	February 6	The Disney Devlin Mfg. Co. (Ltd)	Hanover	Chairs	Walter Dowling	.....	Finger cut off by shingle saw; not operating it.
31	" 15	Bennett Furnishing Co.	London	Furniture	John Parkinson	35	Three fingers, left hand, cut by jointer.
32	" 21	"	"	"	Jas. Anderson	40	Three finger tips, left hand, cut off by shaper.
33	" 25	"	"	"	Walter Butler	35	Three fingers cut by shaper; one badly.
34	April 9	"	"	"	Louis McConathy	45	Right hand cut by circular saw.
35	August 17	"	"	"	Arthur Baker	17	Hand caught in rollers of sander; carelessness.
36	February 11	Hanover Mfg Co.	Hanover	"	Chas. Legge	.....	Right thumb partly cut off by jointer.
37	" 26	The Knechtel Furniture Co. (Ltd.)	"	"	W. Bernie	18	Right thigh struck by a board thrown from a saw,

38	April	4	"	"	"	John Merner.....	20	Two fingers crushed in gears of sticker.
39	"	12	"	"	"	Geo. Walker.....	40	Two fingers cut by rip-saw; hand slipped.
40	"	12	"	"	"	Hy. Schroeder.....	22	Leg injured by boxes falling on it.
41	"	19	"	"	"	Fred. Becker.....	35	Hand struck by piece of wood thrown from planer.
42	"	19	"	"	"	John Kahn.....	22	Thumb and first finger cut off by rip-saw.
43	"	25	"	"	"	R. Disney.....	17	Knee came in contact with band saw under table.
44	May	6	"	"	"	F. Foster.....	.....	Arm, leg and face cut by falling of elevator platform, owing to a loose set screw.
45	Novemb'r	22	"	"	"	Aug. Trade.....	50	Part of first finger, right, cut off by jointer.
46	February	7	"	Brantford	Bicycles	Jas. Mathew.....	.....	End of finger taken off in a swedging machine.
47	June	26	"	"	"	Jas. Kennedy.....	18	One finger cut off and two injured in a press.
48	February	20	"	Hespeler	Woolens	Jos. Fitton.....	50	Left wrist and cheek bone broken, fell off ladder.
49	Septemb'r	16	"	"	"	Mary McCreary.....	.....	Two fingers off in loom chain bevel gear; cleaning in motion.
50	February	18	"	Berlin	Buttons	Boy.....	.....	Scalp torn; caught between elevator and floor beam above.
51	December	14	"	"	"	Thos. Schuer.....	.....	Two fingers cut off by a saw.
52	May	3	"	"	"	Pet. Anthony.....	.....	Thumb cut off below nail by a rip saw.
53	"	25	"	"	"	Conrad Taler.....	.....	Two fingers cut off by buzz planer.
54	April	25	"	"	"	Hy. Toplow.....	.....	Two finger ends off by stripper; foot power.
55	November	7	"	"	"	Hugo Knell (fatal)	28	Fell down elevator shaft.
56	February	24	"	Toronto	Biscuits, etc.	Hart Streeter.....	20	Two fingers cut by tonguing and grooving machine.
57	March	6	"	"	Coffins, shir ds, etc	Michael Cronan.....	.....	Hand; stumbled on saw.
58	February	4	"	"	Mould g's, murr s.	Chas. Goodman.....	17	Finger pinched in gears; cleaning in motion.
59	October	2	"	"	Hosiery	Margt. Thornton.....	.....	First finger off; caught in parallel motion.
60	March	10	"	"	Stoves, etc.	A. Mudder.....	.....	Ankle broken by a pattern falling on it.
61	"	24	"	"	"	Hy. Fitzgerald.....	.....	Fell on hot iron and was burned.
62	"	13	"	"	L'd pipe saws, etc	E. Stewart.....	19	Leg; stepped in barrel of hot water.
63	"	22	"	"	Shades	Geo. Murphy.....	16	Finger injured in die press.
64	July	10	"	"	"	Marlin Cronin.....	24	One finger cut by boring machine.
65	April	11	"	"	"	J. Lambert.....	18	Two fingers cut by boring machine.
66	March	.....	"	"	Coffins, etc.	E. J. Turner.....	40	Hand lacerated in sand papering machine.
67	"	.....	"	"	"	Wm. Lynn.....	.....	Two fingers cut by tenoning machine.
68	August	.....	"	"	"	Geo. Elder.....	.....	Fingers torn by teaser.
69	April	11	"	"	Corsets, pap b's	Boy.....	15	Two ribs; fell down elevator shaft; platform was moved.
70	June	8	"	"	Engines, etc.	M. Nichols.....	.....	Shoulder dislocated.
71	Novemb'r	14	"	"	Shipyards	Hy. Smith.....	.....	Thumb crushed in a chain hoist.
72	April	11	"	"	Dress shields	Wm. Moore.....	.....	Hip; fell off elevator platform to the bottom, 40 feet.
73	August	14	"	"	Radiators	Chas. Price.....	.....	Fingers 2 and thumb cut off by a pinching press.
74	Septemb'r	13	"	"	"	Geo. Clark.....	.....	Foot burned with molten iron.
75	October	31	"	"	Beer	R. Delaney.....	.....	Head cut by tripping over bars of iron.
76	January	11	"	"	Blinds, etc.	Wm. Hays (fatal)	45	Found unconscious at foot of stairs.
77	August	.....	"	"	"	Gordon Douglass.....	.....	Thumb cut by rip saw.
78	"	25	"	"	Engines, etc.	L. Watson.....	.....	Three fingers cut by rip saw; carelessness.
79	Sept.	30	"	"	Chocolate	Thos. Reeves.....	.....	Two fingers cut off by a jointer.
80	November	.....	"	"	Matresses	Alex. Hawthorne.....	.....	Hand injured under roll of melanger.
81	"	14	"	"	Curling hair	Robt. Walker.....	15	Hand hurt by reaching in back of picker.
82	August	28	"	"	"	Alf. Nightingale.....	17	Killed by bursting of cylinder of hair picker.
83	"	26	"	"	Decorat'd tinw're	Harry Jefferson.....	22	Thumb smashed in stamping press.

No.	Date.	Employer.	Place.	Business.	Person injured.	Age.	Particulars.
84	Sept.	McDonald Mfg. Co.	Toronto	Decorative tinware	W. McHugh	17	Finger top off in a stamping press.
85	December	"	"	"	T. Hagarty	19	Two finger tips taken off by a stamping press.
86	"	Dominion Paper Box Co.	"	Paper boxes	Ethel Fahey	15	Hand crushed in platen of creaser; amputated.
87	"	M. Staunton & Co.	"	Wall paper	Boy	.....	Hurt in chest, fell against a nail; three stitches.
88	"	"	"	"	Man—printer	.....	Thumb jammed between wheel and chain; cleaning in motion.
89	"	The Barber & Ellis Co., (Ltd.)	"	Envelopes	Effie Henry	.....	Finger cut in staying machine.
90	"	Whitworth & Restall	"	Mattresses	Margt. Cronin	.....	Arm, face and body burned by fire: the room taking fire.
91	February	Park Bros.	Chatham	Machinery	H. Verrall	.....	Hand caught in lathe dog and cut.
92	"	McClary Mfg. Co.	London	Metal stamping	Harry Harris	18	Three fingers cut and one cut off by metal press.
93	March	"	"	"	A. McLarty	17	Finger finger off at first joint by stamping press.
94	July	"	"	"	A. Johnson	19	Finger bone broken in a press.
95	February	City Sash and Door Factory	"	Sash, etc.	Martin Shabacker	70	Finger tips cut off by saw; hand slipped.
96	March	London Box Mfg. Co., (Ltd.)	"	Boxes	A. Hicks	17	Thumb and first finger cut off by jointer.
97	October	The McCormack Mfg. Co., (Ltd.)	"	Biscuits, etc.	Ed. Stinson	18	Foot crushed by a stone slab falling on it.
98	November	Canadian Packing Co.	"	Pork	*Niels Peterson	30	Handling a belt, standing on ladder got entangled.
99	"	Forest City Steam Laundry	"	Laundry work	Miss Stewart	.....	Fingers hurt in gears of ironing machine; cleaning in motion.
100	March	W. H. Storey & Son	Acton	Gloves	*Robt. Jas. Wilson	16	Wound around shaft; lived an hour.
101	"	Owen Sound Iron Works	Owen Sound	Foundry	*Jas. Agnew	48	Scalded; seated on edge of vat and fainted.
102	April	John Findlay	"	Saw mill	*Duncan Campbell	40	Struck by a board thrown by a circular saw.
103	"	Anderson Furniture Co. (Ltd.)	Woodstock	Furniture	R. M. Gilhooly	32	Finger cut off at first joint by shaper.
104	August	"	"	"	W. Coult	22	Two fingers cut by circular saw.
105	June	Thomas Organ & Piano Co. (Ltd.)	"	Organs	Thos. Ratcliffe	50	Thumb caught in rolls of planer.
106	November	"	"	"	Hy. Douglass	39	Finger tip cut off by saw.
107	December	Hay & Co.	"	Furniture	*Ed. Yeman	29	Crossing vat of hot water; fell in.
108	April	The Chippewa Lumber Co.	Southampton	Sash and doors	M. C. Johnston	.....	Left arm cut off at shoulder; was reaching over planer to oil.
109	March	The Southampton Mfg. Co. (Ltd.)	"	Furniture	Albert Eby	.....	Left hand cut by saw.
110	June	"	"	"	Donald Turner	.....	Right hand cut by boring machine.
111	July	"	"	"	Neil Turner	.....	Left hand cut by buzz planer.
112	April	"	"	"	David McLaren	.....	Finger cut by saw.
113	June	"	"	"	Adison Nahrang	.....	Right thumb cut by planer.
114	Sept.	"	"	"	Geo. Miller	28	Two fingers cut, and one cut off by rip saw.
115	April	Cockshut Plow Co.	Brantford	Plows	D. S. Tuiford	48	Two fingers cut off, and palm cut by rip saw.
116	July	Waterous Engine Works Co. (Ltd.)	"	Engines and machinery	Max. Batchelor	.....	Arm broken and cut; brake chain slipped and fly wheel striking him.
117	October	"	"	"	T. Moore	.....	Shaken up generally; fell off lumber pile
118	"	"	"	"	S. Harding	.....	Foot burned by molten iron.
119	November	"	"	"	W. Little	.....	Eyes burned while pouring babbit metal.
120	"	"	"	"	W. Whitaker	.....	Head and shoulders, by piece of crane falling.

121	"	27	"	"	"	Geo. Sheart.....		
122	Sept.	14	Brantford Carriage Co.....	"	Carriages	Robt. Sutton	Feet bruised by weight falling from crane; thread stripped.	
123	October	30	Canada Cycle & Motor Co. (Ltd)	"	Motors, etc	Chas. Stevenson	Finger cut off by shaper fitted with a saw.	23
124	November	17	The Singaby Mfg. Co. (Ltd)	"	Blankets	W. A. Porter	First finger crushed in a press.	42
125	March	1	Globe Furniture Co. (Ltd)	Walkerville	Furniture	Mr. Harvey	Cleaning doffs; arm caught and flesh torn.	30
126	June	19	"	"	"	Mr. Harvey	Two fingers cut off at first joint by a jointer.	
127	December	13	"	"	"	Harvey Wilson	First finger cut off by a shaper.	
128	April	28	Goderich Organ Co.	Goderich	Organs	Jas. Cuthbert	Two fingers cut off by a jointer.	
129	"	27	The C. Beck Mfg. Co (Ltd)	Penetanguishene	Lumber	Wm. Nevills	Four fingers cut off by a buzz planer.	
130	"	29	D. Maxwell & Sons	St. Mary's	Agr. implements	Hy. Robinson	Fingers cut by saw; cleaning below table.	
131	Sept.	6	J. D. Moore & Co	"	Planing	Adam Moore	Hand lacerated by knives of joining machine.	
132	May	3	Kenedy & Downs	Sreanore Siding	Lumber	*Chas. Dawson	Right arm cut off in a dovetailing machine.	14
133	Jan.	21	Preston Furniture Co	Preston	Furniture	Man	Stuck by belt flying around shaft.	
134	May	16	Waterloo Mfg. Co. (Ltd)	Waterloo	Agr. implements	J. Wiergarth	Two fingers cut by saw; not careful.	
135	June	19	The S. Hadley Lumber Co. (Ltd)	Chatham	Planing, etc	Samuel Barnes	Face burned by molten iron flying from p.t.	
136	February	"	McKee & Trotter	"	Machinery	Albert Jones	Hand and two fingers cut by shaper.	
137	June	13	J. Liggett & Sons	"	Planing, etc	Arch'd Kemp	Finger cut off by shaper.	20
138	Sept.	6	"	"	"	John La Francis	Two fingers cut and two broken; piece slipped on shaper.	49
139	July	6	The McGregor Foundry Co. (Ltd)	Galt	Machinery	John McAuslan	Two fingers cut; placed hand on moving saw.	17
140	August	29	Victoria Wheel Works	"	Wheels	H. A. Bartlett	Finger point off in a lathe.	
141	March	3	Alex. Smith	Guelph	Axles	Wm. Vann	Arm lacerated by saw while throwing off belt.	19
142	August	3	J. B. Armstrong Mfg. Co. (Ltd)	"	Carriage boxes	Chas. Easton	Arm torn; caught in set screw of reamer.	25
143	Sept.	1	"	"	"	Wm. Grey	Finger cut by saw.	
144	June	6	Robt. Stewart	"	Planing, etc	Thos. Sole	Leg hurt by contact with shaper spindle.	21
145	October	24	Bel Organ and Piano Co. (Ltd)	"	Organs, etc	Chas. Fennel	Three fingers right hand cut off by rip saw.	19
146	July	11	The Morris, Field, Roger Co. (Ltd)	Liskowel	Pianos	A. Rocker	Finger tips cut off by buzz planer.	
147	March	12	A. Tat	Orillia	Lumber	Angus Campbell	Three fingers cut by shingle saw.	21
148	Sept.	12	F. Stearus & Co	Windsor	Medicines	Nellie Dixon	Hand crushed in pill rolls; two fingers amputated.	
149	"	12	Strathroy Furniture Co	Strathroy	Furniture	Wm. Gorrie	Three fingers cut by shaper knives.	25
150	"	3	J. R. Eaton	Orillia	Planing, etc	Jno. Sullivan	Thumb and first finger cut off by moulder.	45
151	November	3	The Sichel Furniture Co (Ltd)	Walkerton	Furniture	Jas. Hughes	Leg hurt by hand drum; broke off piece of b. ne.	
152	May	28	J. M. Green & Co	St. Thomas	Planing, etc	Wm. J. Green (Sen.)	Two fingers off by jointer.	
153	November	18	The Noxon Mfg. Co. (Ltd)	Ingersoll	Agr. implements	*Chas Foster	Supposed he fell in the fly wheel.	22
154	August	9	The Ellis Furniture Co	"	Furniture	Sam. A. Baker	Arm cut by a band saw.	29
155	October	27	"	"	"	Aug. Tode	Part of finger cut off; jointer.	50
156	"	30	Victoria Harbor Lumber Co	Victoria Harbor	Lumber planing	Felix Juneau	Forearm cut; lifted planer top, sleeve caught in knives, drew in arm, severely cut it.	22
157	August	21	Octavius Newcombe & Co	Toronto	Pianos	Jos. Goodwin	Three fingers, two cut off at first joint and one stiffened, in a jointer; neglected to put work in proper place, it toppled over and forced hand on to the knives.	45

*Fatally.

ACCIDENTS REPORTED IN 1899.—CENTRAL DISTRICT.

No.	Date.	Employer.	Place.	Business.	Person injured.	Age, years.	Particulars.
1	1898 December 31	Lincol'n Paper Mill Co.	Merriton	Paper	John Wilson (fatal)	19	Died from injuries received on a hoist. The pulleys of the hoist being defective, new pulleys had been provided and were to have been put in use on the day the accident occurred. The accident occurred at 4 a.m.
2	1899 January 10	Hamilton Cotton Co.	Hamilton	Cotton	William O'Reilly	...	Slipped on floor, top joint of third finger on right hand cut off in quadrant gear of spinning mule.
3	"	Firstbrook Bros.	Toronto	Boxes	George Gallagher	35	Wrist of right hand caught between belt and pulley and broken in three places.
4	"	Rathbun Co.	Deseronto	Sash and door factory.	William Fraser	59	Hand cut; struck with a piece of wood thrown from saw.
5	"	Capital Planing Mill Co.	Ottawa	Planing, etc.	H. Staighs	...	Two fingers on left hand cut off while operating sticker.
6	"	Riordan Paper Mills Co., (Ltd.)	Merriton	Paper	James Byron	17	Right arm badly bruised; caught between two rolls on wet machine.
7	February 4	Northey Mfg. Co.	Hamilton	Tin cans	James McSwain	18	Nail torn off thumb on left hand; caught in power press.
8	"	Kemp Mfg. Co.	Toronto	Tin and enamel'd ware.	William Parsonson	22	First joint of first finger on left hand crushed in power press.
9	"	Geo. Matthews Co., (Lid.)	Peterborough	Pork packers	Nathan Nicholls (fatal)	46	Caught in belt and wound round shaft. Died five hours after accident.
10	"	St. Lawrence Foundry Co., (Ltd.)	Toronto	Castings, etc.	Thomas Mines	35	Ankle broken by the upsetting of an anvil.
11	"	Office Special Mfg. Co., (Ltd.)	Newmarket	Office specialties	Wellington H. Travis	22	Little finger of left hand cut on rip saw, and struck on stomach by board thrown from rip saw.
12	"	Kemp Mfg. Co.	Toronto	Tin and en. ware	Albert Rosstter	22	Little finger on right hand crushed in power press.
13	"	Wm. B. Hamilton Son & Co.	Toronto	Boots and shoes.	Elmer Mitchell	17	Hand injured on knife of machine; flesh wound on finger.
14	"	Peter Hamilton Mfg. Co.	Peterborough	Agricultural machinery.	Henry Mauley	24	Part of flooring falling in, he was precipitated into the cellar; right hand bruised and torn.
15	"	Standard Chemical Co., (Ltd.)	Deseronto	Chemicals	William S. Battick (fatal)	32	Entangled and carried around shaft while shifting belt on pulley.
16	"	Trent Valley Woolen Co.	Campbellford	Woolens	M. Killoran	20	Points of fingers crushed while cleaning loom in motion, against orders.
17	"	Kemp Mfg. Co.	Toronto	Tin and japanned ware.	Joseph Storey	18	Two first fingers on left hand crushed in die of power press.
18	March 6	H. A. Lozier & Co.	Toronto Junction	Bicycles	Philip Clark	23	Chain got caught in blifing wheel; two first fingers on right hand lacerated.
19	"	Office Specialty Mfg. Co.	Newmarket	Office specialties	Robert Ginty	37	Rested gun on his knee in firing it up smoke stack to remove soot. Recoil broke his leg.
20	"	H. A. Lozier & Co.	Toronto Junction	Bicycles	Henry W. Fowler	56	Ankle badly sprained; fell off a ladder.

21	"	16	Norton Mfg. Co	Hamilton	Tin cans	William Watling	19	Middle finger of right hand amputated at first joint in power press.
22	"	6	John Bertram & Sons	Dundas	Machine tools	S. Clark	28	While drilling with turning lathe, drill caught, little finger of left hand cut off, and palm of right hand crushed.
23	"	25	Kemp Mfg. Co.	Toronto	Tin and enam'd ware.	Daniel McAllister	24	First finger left hand crushed on bolt of die in power press.
24	February	24	Auburn Woolen Co.	Peterborough	Woolens	Sarah Marshall	18	Hand caught in belt; slightly injured.
25	March	22	Auburn Woolen Co.	"	"	Andrew Hense	45	One finger cut off and another partly cut off in gear.
26	April	1	Gilmour & Co.	Trenton	Sash & door facy	Alfred Lewis	21	Little finger on right hand badly cut by circular saw.
27	March	27	James I. Clark	Rosseau	Shingles	Angus Fraser	45	Three fingers cut off by circular saw.
28	"	31	Canadian Col'd. Cotton Mills Co.	Hamilton	Cottons	Maggie Strong	45	Nose and forehead slightly cut by shuttle flying from loom.
29	January	14	Ontario Rolling Mills Co.	"	Bar iron	Victor Theret	45	Two fingers on right hand cut off while flanging rails on shears.
30	February	27	"	"	"	John Scott	45	Left arm amputated; caught between piece he was planing and leg of planer.
31	March	6	"	"	"	J. Choat	45	Piece flew from shears striking him over the knee, causing effusion of knee joint.
32	April	10	"	"	"	John Galtrey	42	Right fore arm fractured, by piece of iron flying from hammer while breaking axles.
33	"	14	Keup Mfg. Co.	Toronto	Tin and metal ware.	Ernest Andrews	34	Three fingers on right hand amputated in dies of power press.
34	"	4	John Gillie's Estate	Carleton Place	Tweeds and worsteds.	John McKenzie	33	Right foot injured; elevator cable broke, car fell one flat from bottom.
35	"	4	"	"	"	Robert France	40	Left foot injured;
36	"	8	Sadler, Dundas & Flaville Milling Co.	Lindsay	Milling	John A. McMillan (fatal)	...	Found with body lying over shaft. Head at one side and feet at the other. Left leg broken in two places. Injured internally. Died eighteen hours after the accident.
37	"	14	Ontario Rolling Mills Co.	Hamilton	Bar iron	Richard Hamilton	35	Left foot badly bruised, caught between two plates while loading a car.
38	"	20	Gilmour & Co'y	Trenton	Sash & door factory.	Walter Clark	21	First finger of left hand mangled at knuckle while operating mortising machine.
39	"	24	Canadian Col'd. Cotton Mills Co.	Merrittion	Cottons	Etta Dundas	18	Nail in board left on floor ran into ball of her right foot. Injury reported slight.
40	"	25	William Mitchell	Cobourg	Matts & matting	Annie Lavis	17	While holding a skein of yarn on her left arm it was caught on shaft and arm broken in two places.
41	January	6	Sylvester Bros. M'fg. Co.	Lindsay	Harvesting machinery.	O. W. Routley	42	Thumb and forefinger of right hand amputated in buzz planer.
42	May	2	Ottawa Car Co	Ottawa	Cars, carriages, etc.	Adam Young (fatal)	...	Struck on the abdomen by piece of wood thrown from circular saw. Died fifty-five hours after the accident.
43	"	3	Kemp M'fg. Co	Toronto	Tin and stamped ware.	Henry Lingenfelter	24	Second finger on left hand cut off at first joint, on power press.
44	"	3	Canadian Col'd. Cotton Mills Co.	Hamilton	Cottons	Ben. Gibson	23	Second finger on left hand cut off at first joint by knives of cloth folder.
45	"	8	Sylvester Bros. M'fg. Co.	Lindsay	Harvesting machinery.	James Daniels	...	Foot very badly burned by molten iron.
46	"	12	"	"	Harvesting machinery.	Samuel Reazin	...	Hand badly cut on jointing planer.

ACCIDENTS REPORTED IN 1899.—CENTRAL DISTRICT.—Continued.

No.	Employed.	Place.	Business.	Person injured.	Age.	Particulars.
	1899				years.	
47	May 15	Hamilton	Tin cans	Fred. Elliott	14	Fleshy part of second and third fingers of left hand cut off in die of foot press.
48	" 12	Hamilton	Bar iron	Fred. Homer	40	Rail fell off buggy, cutting right leg above ankle.
49	" 12	"	"	Andrew Rigby	38	While cutting rivets one flew severing radial artery.
50	" 17	"	Tin cans	W. Vollick	17	Bad flesh wound on middle finger of left hand, while removing scrap tin from machine while in motion.
51	" 19	"	"	William Fee	18	Thumb caught between horn and bumper of press. Thumb amputated at nail.
52	" 16	Merriton	Cottons	Mrs. Castick	50	Loom weight fell on left foot; foot injured.
53	" 19	Bracebridge	Lumber	William J. McFadden	38	Struck by saw carriage; scalp wound and fingers injured.
54	" 20	Newmarket	Office specialties	Alex. Gibson	18	While screwing a nut on a spindle while in motion, nail torn off first finger of left hand.
55	" 16	"	Wooden ware	Roy Trivett	16	Crawled under rip saw table, raised his head, saw cut through skull.
56	June 3	Lindsay	Shingles, lumber, etc.	*Garnet Steamburg	17	Fell on a circular saw in motion. Killed instantly; had only worked three weeks in mill. Worked on a farm formerly.
57	" 8	South River	Lumber, lath, & shingles.	Charles Bell	19	Four fingers of right hand cut off on circular saw.
58	" 9	Merriton	Cottons	Martin McDonald	19	Flying shuttle from loom flew out and struck the end of finger, breaking the nail.
59	" 9	"	"	William Greenwood	45	While cutting a picker, cut palm of his left hand.
60	" 15	Toronto	Knitted goods	George Hull	.....	Caught in driving belt of card machine; scalp wound.
61	" 20	Merriton	Cottons	Elsie Miller	20	Shuttle flew out of loom and struck her below the left eye; skin not broken.
62	" 4	Toronto	Biscuits	Herbert Scarr	.....	Partial loss of left hand, having been caught in grinding machine.
63	" 20	"	Boxes	*Samuel Bailey	18	Had crawled under rip saw. Two cuts in head from which death resulted.
64	" 29	Campbellford	Woollens	Barney Frederick	35	Put hand in burring machine while in motion. Arm broken.
65	" 30	Peterborough	"	Fred Sanderson	18	Three fingers of hand taken off in gear.
66	July 5	Newmarket	Office specialties	George Peppatt	21	Second finger of left hand cut off at first joint, and the tops of first and third also cut off on jointing planer.
67	" 11	Toronto	Tinned stamped ware.	Stuart Tassey	17	First joint of first finger of right hand crushed in rivetting machine.

68	July	11	William Morrison	Lambton Mills.	Woolens	Edward Waterhouse....	16	Right arm caught in gear of card; flesh wound on arm and right leg.
69	"		Rathbun Company	Gravenhurst....	Lumber	William Splan, sr.	55	Rope broke on swing saw. Cut between shoulder and elbow.
70	July	13	Ontario Rolling Mills Co.....	Hamilton	Bar iron	Albert Addley	25	While drawing buggy load of iron one of the wheels crushed his foot.
71	"	15	Ottawa Saw Works Co.....	Ottawa	Saws	Thomas Graham .....	.....	Grindstone burst; small cut on face and arm; loss of one front tooth and a few bruises on face.
72	"	8	Pedlar Metal Roofing Co.....	Oshawa	Metal building material.	Thomas Considine	35	Index finger of right hand amputated at second joint in dies of power press.
73	"	12	Ottawa Car Company	Ottawa	Cars	J. Kilby	21	Second finger of left hand cut off at first joint on buzz planer.
74	"	17	Gilmour & Co	Trenton	Boxes	Joseph Campbell	30	Index and middle fingers of right hand cut on circular saw.
75	"	18	Canad'n Colored Cotton Mills Co	Hamilton	Cottons	Maggie Sinclair	20	Two fingers on right hand jammed between picking cam and loom beam head.
76	"	20	Kemp Mfg. Co.	Toronto	Tin and metal ware.	William Smith	20	Left wrist cut while passing a pile of tin plate.
77	"	15	Ontario Rolling Mills Co. (Ltd.).	Hamilton	Bar iron	Samuel Thoomb	35	While handling an axle it dropped on his knee, scraping leg between knee and ankle.
78	"	25	Kemp Mfg. Co.	Toronto	Tin and metal ware.	Richard Blair	22	Second finger on left hand crushed at first joint in punching press.
79	August	5	Joseph Simpson's Sons	"	Knitted goods ..	Wm. Boyington .....	.....	Fell and fractured a rib while crossing an excavation in factory.
80	"	4	Peter Hamilton Mfg. Co.....	Peterboro'	Agricultural machinery.	Hampden Doten	19	Right hand injured on wood-boring machine.
81	"	9	Firstbrook Brothers	Toronto	Boxes	Wm. Robinson	25	Thumb of left hand taken off at first joint on circular saw.
82	"	21	Kemp Mfg. Co.	"	Tin and metal ware.	Alexander Boyd	16	Thumb on right hand cut off at first joint while burring muffin pans.
83	"	20	Hamilton Blast Furnace Co.....	Hamilton	Pig iron	James Lacy	43	Struck by railway car; left foot bruised and crushed.
84	"	24	"	"	"	P. Doyle	24	Piece of pig iron fell on his left hand; flesh and nail torn off.
85	"	9	Knight Bros. Co.	Burke's Falls...	Sash and door factory.	Joseph Appleyard .....	.....	Arm caught in band saw; flesh wound in forearm.
86	"	24	Canad'n Colored Cotton Mills Co	Hamilton	Cottons	Robert French	30	Raised cover to beater on one of the pickers while in motion; first finger on right hand cut.
87	"	25	Lincoln Paper Mills Co	Merrittton	Paper	Wm. Williamson	35	Fell off chain on which he was standing against part of machine and broke three ribs.
88	"	30	Norton Mfg. Co.	Hamilton	Tin cans	Arthur Dawson	25	Third finger of right hand amputated above first joint between dies of press; second finger bruised.
89	"	31	Hamilton Blast Furnace Co.....	"	Pig iron	George Robbins	28	Bar slipped while raising sow of iron and Robbins fell on hot iron, burning hands, knees and hip.
90	September 4		Gillies Bros. Co. (Ltd.)	Braeside	Lumber	* Frank Reid	36	While operating the edger an edging flew back, striking him on the groin, severing an artery; bled to death within ten minutes.
91	"	8	St. Lawrence Foundry Co. (Ltd.)	Toronto	Castings	Joseph Mitchell	24	Fingers crushed while handling a steel beam.

* Fatal.

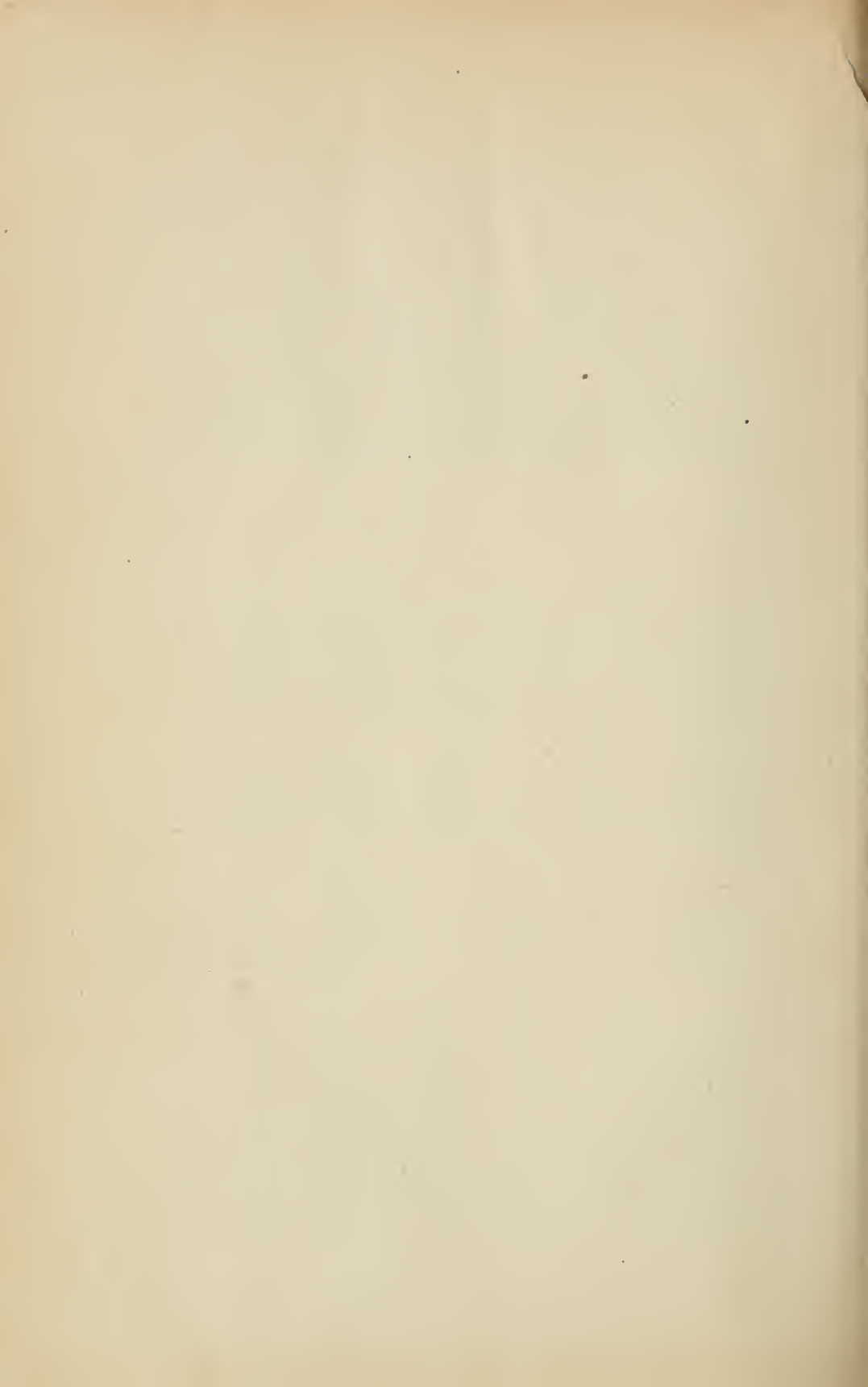
ACCIDENTS REPORTED IN 1899—CENTRAL DISTRICT.—Continued.

No.	Date.	Employer.	Place.	Business.	Person injured.	Age.	Particulars.
92	Sept.	12 St. Lawrence Foundry Co. (Ltd.)	Toronto	Castings	John Livingston	40 years.	Crane chain breaking caused an iron column to fall against him, breaking his leg.
93	"	8 Gendron Mfg. Co.	"	Reed furniture, etc.	Wm. Nye	36	Fell off a ladder while lacing a belt; arm broken.
94	"	8 John Gillies Estate, (Ltd.)	Carlton Place.	Woodlens	Joseph Burrows	16	Back of right hand lacerated; caught between the rubber roller and doffer of the cards.
95	"	14 Ontario Cotton Mills Co.	Hamilton	Cottons	Walter Dunneth	20	Put hand inside picker to clean out cotton before it stopped; first finger of left hand broken.
96	"	14 J. R. Booth	Ottawa	Lumber	Lawrence Dooly (fatal)	26	One of the splitter runners being away, Dooly (whose work it was to cart slabs from one mill to another) went to shove a slab through the rolls. A man at the adjoining splitter ordered Dooly away, but at that instant his hand was caught and pulled through the rolls. He was cut in the rump and died half an hour after. He was under the influence of liquor, and as it was starting time (7 a.m.) the foreman had not seen him.
97	"	9 Wm. Cane & Sons Mfg. Co.	Newmarket	Woodenware	Alexander Potter	40	Scalded by the bursting of two cast-iron "Ts" on steam-pipe leading from the boiler to the engine. Thinness of the metal in the "Ts" supposed cause of accident.
98	"	Hamilton Brass Mfg. Co.	Hamilton	Cash registers	Wm. Beattie	.....	Loss of eye while assisting to put belt on a pulley.
99	"	"	"	"	James Smith	.....	Cause of accident reported as being unknown. Finger crushed in milling machine.
100	"	16 Huntsville Lumber Co.	Huntsville	Lumber	Walter Langridge	16	While putting on a belt, right arm caught and broken in three places; arm amputated near the shoulder.
101	"	16 Riordan Paper Mills (Ltd.)	Merriton	Paper	Joseph Little	35	Fell from a wood conveyer twenty-five feet to the roadway. Cut on head and ankle sprained.
102	"	18 " "	"	"	Patrick Sheehan	72	While loading sulphur sack on a wagon, slipped and fell on his head, sustaining a slight concussion.
103	"	15 Hamilton Steel & Iron Co.	Hamilton	Forgings, etc.	Charles Marsh	23	Third finger of right hand broken, caused by chain of crane breaking while assisting in hoisting a heavy forging.
104	"	19 " "	"	"	Wm. Wilson	45	Top of thumb cut off in shear.
105	"	20 " "	"	"	A. Pitt-ack	24	While cutting scrap plate, it doubled between blades, causing thumb to be caught, taking off nail.

106	May	3	McLachlin Bros.	Arnprior	Lumber	Ernest Hawthorne	22	Thumb of right hand cut on circular saw.
107	September	1	"	"	"	John Farrell	18	Finger of left hand cut off while oiling lathe.
108	"	26	Christie Brown & Co.	Toronto	Biscuits	Thomas Ross	21	Right hand cut in dough mixer.
109	"	28	J. R. Booth	Ottawa	Lumber	Joseph Roussell	45	Three fingers of left hand caught in gear and amputated.
110	"	22	J. R. Booth	"	"	Joseph Clontherier	45	Fingers amputated, putting hand under transfer table caught in gear.
111	"	27	Rosamond Woollea Co.	Almonte	Woollens	Fred. Young	18	Arm lacerated; caught in cylinder of carding machine.
112	October	3	St. Lawrence Foundry Co	Toronto	Castings	E. Boyd	45	Fell into a pit about sixteen feet deep.
113	"	11	"	"	"	A. Morrow	15	Burned by spilling of molten iron.
114	"	3	W. C. Edwards & Co.	Ottawa	Lumber	Antoine Bone	35	Foot caught between live rollers, and three toes amputated.
115	"	18	Ontario Cotton Mills Co.	Hamilton	Cottons	David Miller	20	Heel of right foot badly bruised, caught between elevator car and floor.
116	"	12	W. D. Lummis	Spragge, District Algoma.	Lumber	Chas. W. Wardner (fatal)	..	It is supposed that he was throwing a belt off a pulley with his hand upon which he had a mitt, and got caught in the belt and carried around the shaft until the belt broke. When the noise was heard the mill was stopped, and the body of deceased was found lifeless.
117	"	20	The Riordan Paper Mills (Ltd.).	Merriton	Paper	John Eppler	43	Fell from a truck in chemical room. Right arm fractured.
118	"	23	The Rathbun Co.	Deseronto	Lumber	Walter Lucas	25	Lost first finger on left hand on circular saw.
119	"	28	The Kemp Mfg. Co.	Toronto	Metal ware	Frank Thoms	18	Thumb on left hand crushed at first joint on a grooving machine.
120	November	4	Firstbrook Bros.	"	Boxes	William Merson	18	Thumb and first three fingers on left hand cut on rip saw.
121	"	2	Kemp Mfg. Co.	"	Metal ware	John Bateman	18	Thumb on left hand crushed at first joint on a grooving machine.
122	"	8	"	"	"	Edward Marks	20	Second finger at first joint cut off while burring muffin pans.
123	"	8	The Rathbun Co.	Deseronto	Sash & door f'ct'y	Norval See	16	Bad cut on arm, caused by mortising machine.
124	"	9	"	"	Cedar mill	Alex. Wilkins	32	While repairing drive belt, engine made a quarter turn, bruising him.
125	"	9	Kemp Mfg. Co.	Toronto	Metal ware	Daniel Rumpfle	17	Left hand injured in cogs of elevator; no bones broken.
126	"	10	"	"	"	Percy Davis	16	Part of first joint on first finger of right hand crushed in riveting press.
127	October	30	Canada Cycle & Motor Co. (Ltd.)	Toronto	Bicycles and motor vehicles.	Roland Nelles	23	Little finger of right hand partly crushed in machine.
128	November	14	Sault Ste. Marie Pulp and Paper Co.	Sault Ste. Marie.	Pulp and paper.	William Young (fatal)	17	After removing a belt from a pulley which was running a small saw, he put his foot on the belt while it was still moving, causing the belt to bind on the shaft, and a loop of the belt catching his legs drew him around the shaft, causing instant death.
129	"	2	Pugsley, Dingman & Co.	Toronto	Soap	Joseph Armstrong	20	Fell down elevator shaft, considerably bruised.
130	"	16	Firstbrook Bros.	Toronto	Boxes	Wm. Bradshaw	19	The second finger of right hand cut off on saw; first finger cut off at second joint; third finger badly cut; thumb also cut.

ACCIDENTS REPORTED IN 1899—CENTRAL DISTRICT.—*Concluded.*

No.	Date.	Employer.	Place.	Business.	Person injured.	Age.	Particulars.
131	November 21	Norton Mfg. Co.	Hamilton	Tin cans	George Wingert	15	Took hold of the gallon body machine connecting rod while in motion; little finger of right hand pinched.
132	"	Christie, Brown & Co. (Ltd.)	Toronto	Biscuits	Peter Hagan	17	Neck grazed while hanging over the elevator while in motion.
133	"	St. Lawrence Foundry Co.	"	Castings	Frederick Gee	17	Was lowering crane, took off handle and ran wheel with hand. Hand slipped in gear of crane. Four fingers of right hand badly crushed and lacerated.
134	"	Canada Cycle & Motor Co. (Ltd.)	Toronto Junction	Bicycles	C. S. Armitage	45	Thumb badly cut and loss of nail, while operating an automatic machine.
135	December 6	Norton Mfg. Co.	Hamilton	Tin cans	George Jones	23	Half of first joint of index finger of left hand amputated, in dies of power press.
136	"	S. J. D. Shier	Bracebridge	Lumber	Charles Bailey	22	Thumb, first and second fingers of right hand cut off on buzz planer.
137	"	Christie, Brown & Co. (Ltd.)	Toronto	Biscuits, etc.	Ida Creighton	60	Two toes squeezed in elevator.
138	"	St. Lawrence Foundry Co.	"	Castings	Wm. Bow	60	While adjusting upper part of flask on crane it slipped off, bruising lower part of leg.
139	"	Peter Hamilton Mfg. Co.	Peterborough	Agr'l machinery.	Herbert Mowrey	21	Little finger of left hand cut off at second joint; other three fingers lacerated at the points on buzz planer.
140	"	The Riordan Paper Mills (Ltd.)	Merriton	Paper	Arthur Smerdon	30	Cut on the forehead by flying pieces of iron from the broken cover of a wood chopping machine.
141	"	"	"	"	Walter Ekins	34	Ankle of left leg fractured, and deep cut on the left arm while trying to put belt on pulley.
142	"	Hamilton Steel and Iron Co.	Hamilton	Iron and steel bars.	Charles Catlin	20	Eye and face cut and face and neck scalded by gauge glass breaking; neglected to turn off steam before tightening gauge glass.
143	"	Canada Col'd Cotton Mills Co.	"	Cottons	Nellie Cunningham	23	Had the first finger of left hand caught in roll of speeder, and nail torn off; against orders to clean machinery in motion.
144	"	Whitman Barnes Mfg. Co.	St. Catharines	Planer-knives, etc.	Thomas Wilson	.....	While loading boxes, broke his leg between the knee and ankle.
145	August 17	Gendron Mfg. Co.	Toronto	Reed furniture, etc.	W. Blouin	.....	Struck by a piece of wood on the abdomen, thrown from a rip saw.
146	December 29	Gilmour & Co.	Trenton	Sash and door factory.	John Kobold	.....	Half of the first two fingers of right hand cut off on shaper.



REPORT
RELATING TO THE REGISTRATION OF
BIRTHS, MARRIAGES AND DEATHS
IN THE
PROVINCE OF ONTARIO
FOR THE
YEAR ENDING 31ST DECEMBER,
1898.

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO.



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1900.

OFFICE OF THE REGISTRAR-GENERAL FOR ONTARIO,

TORONTO, January 2nd, 1900.

To Sir OLIVER MOWAT, K.C.M.G.,

Lieutenant-Governor of the Province of Ontario.

MAY IT PLEASE YOUR HONOUR :

In compliance with the Statute in that behalf, the undersigned respectfully presents to Your Honour the Annual Report of Births, Marriages and Deaths for the year ending 31st December, 1898.

Respectfully submitted,

J. R. STRATTON,
Registrar General.

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TORONTO, JAN. 2, 1900.

To the Hon. J. R. STRATTON,

Registrar-General of the Province of Ontario.

SIR,—I have the honor herewith to lay before you for your consideration, the twenty-ninth Annual Report regarding Births, Marriages and Deaths in the Province of Ontario, it being for the year 1898.

Population.

The population adopted as the basis of calculation for the tables of this report, is that based upon the Canada census of 1891. It is based upon the arbitrary assumption that there has been an average increase per annum of one per cent. during each year since this period, the increase being dependent upon the difference between the births and deaths recorded during any year. The population adopted for the report of 1897, obtained by the addition of one per cent. to the population as given for each of the counties and territorial districts, was 2,257,378 ; hence the estimated population for 1898 is 2,279,929.

That there may be actually a smaller population in the Province than is obtained by this arbitrary method of calculation, is gathered from the fact that the total recorded increase of births over deaths is 20,229, or 0.89 of one per cent. On the other hand there is good ground for the belief that the number of recorded births does not represent the total births which have actually occurred. Apart from imperfect registration, careful examination of the records reveals the fact that a notable number of still-births are recorded only amongst the deaths. Thus as will be seen from the following table, which shows the total still-births in the 13 cities of the Province, recorded as deaths, of the total 433 still-births, only 201 were recorded as births by the Division-Registrars in their returns to the Registrar-General, or 232 still-births were unrecorded as births.

Still-Births in Cities in 1898, showing the number recorded in Death Schedules as compared with Birth Schedules.

Cities.	Death Schedules.	Birth Schedules.	Per Cent.
Guelph	10	10	100
St. Thomas	6	5	83
Stratford	8	0	.....
St. Catharines	14	5	36
Windsor	20	18	90
Belleville	4	4	100
Chatham	10	10	100
Brantford	25	25	100
London	12	3	25
Kingston	14	12	85
Ottawa	75	15	20
Hamilton	52	35	67
Toronto	183	59	32

By comparing the total still-births 433 in cities, with the total births in cities 9,343, inclusive of all still-births however registered, it is found that the percentage to the whole of still-births is 4.63. If the proportion of still-births bears the same ratio in all municipalities other than cities and are unrecorded as births in the same proportion, then the increase of births in the Province will be 2.5 per cent. added to the total 46,599 recorded births, giving a total of 47,553, or an actual increase of 954. That the neglect to record still-births in births has not, however, prevailed in rural municipalities to the same extent as in cities is gathered from the following table :

Table showing Still-Births by Counties, as recorded under Deaths and under Births, 1898.

Counties.	Total Births, 1898.	Total still-births including in- fants who died under one day old recorded under Deaths.	Still-births re- corded under Births.	Still-births not recorded un- der Births.
Algoma	817	14	13	15
Brant	702	56	31	25
Bruce	1,310	35	32	3
Carleton	2,183	109	92	17
Dufferin	449	10	7	3
Elgin	763	13	10	3
Essex	1,607	45	38	7
Frontenac	919	22	19	3
Grey	1,426	23	22	1
Haldimand	403	3	2	1
Halton	410	9	9	0
Haliburton	222	3	3	0
Hastings	1,202	18	16	2
Huron	1,278	25	21	4
Kent	1,313	59	43	16
Lambton	1,170	26	19	7
Lanark	743	15	14	1
Leeds and Grenville	1,062	7	6	1
Lennox and Addington	467	7	7	0
Lincoln	560	26	19	7
Middlesex	1,615	24	15	9
Muskoka	601	9	9	0
Norfolk	651	10	9	1
Northumberland and Durham	1,218	28	27	1
Nipissing	897	11	9	2
Ontario	854	25	23	2
Oxford	1,073	37	34	3
Peel	408	2	1	1
Perth	999	20	10	10
Peterborough	831	20	29	0
Prescott and Russell	1,623	28	24	4
Prince Edward	305	3	3	0
Parry Sound	680	12	11	1
Rainy River	235	8	5	3
Renfrew	1,357	24	24	0
Simcoe	1,744	30	28	2
Stormont, Dundas and Glengarry	1,338	29	28	1
Thunder Bay	254	6	6	0
Victoria	729	32	32	0
Waterloo	1,151	27	25	2
Welland	656	9	8	1
Wellington	1,197	22	21	1
Wentworth	1,678	66	47	19
York	5,509	212	77	135
Totals	46,599	1,228	928	300

Births.

The total births recorded in 1898 were 46,599, as compared with 47,323 in 1897, showing a decrease of 724 for the year. The rate calculated per 1,000 is 20.4, or a decline of 0.5 per 1,000 for 1897. The variations as regards increases and decreases are set forth in table 1 of this report (page 28). The distribution of the increases and decreases by counties is a matter of much interest as indicating both the effects of movements of populations and variations in their social status; as also the degree of thoroughness with which returns are made and collected. In examining the returns there is seen a total increase in the cities of 174 births over 1897, but a notable decrease appears in the towns, amounting to 174. The counties in which increases and decreases are recorded are set forth in table 1, page 28. Those showing an increase are chiefly those in which, the growing cities are situated. Thus, Carleton shows an increase of 95, Essex has 42, Middlesex 50, Wellington 52, and Wentworth 151. Those showing the more notable

decreases are the counties very largely agricultural. Thus, Bruce shows a decrease of 157, Grey 55, Kent 89, Lambton 61, Leeds and Grenville 60, Ontario 49, Peterborough 59, Renfrew 169.

Such would seem to be the natural results of influences which have been operative for years, due to the change of occupations of the population of a district; but on closer examination into the facts, other elements are found to enter in, which in some instances argue strongly against so satisfactory an explanation. Thus York shows a decrease of 40, although Toronto is situated therein. Brant shows a decrease of 69, with Brantford a rapidly growing city, while Waterloo, a county with an unusual number of growing, manufacturing towns, shows a decrease of 44.

In order that the primary question of completeness of returns may be to some extent determined, a circular was sent to all Division-Registrars on January 25th, 1899, containing the following paragraph:

"The Registrar-General is desirous of obtaining information as to how many Division-Registrars receive the fees for their work as Division-Registrars, as defined under Section 30 of the Act, and how many have the fees commuted by receiving as Municipal Clerk only a salary for which they are expected to do all the work laid upon the Clerk under the Statutes. I shall, therefore, take it as a favor if you will send a card stating in which manner you are paid, as it is desirable that this work should be paid for specially in order that the time necessary for obtaining complete returns may be given to it."

Replies were received from 329 Division-Registrars, and the results of the replies are set down in the following table:

County.	Cities.			Towns and Villages.			Townships.		
	Total.	Yes.	No.	Total.	Yes.	No.	Total.	Yes.	No.
Algoma.....				3	3		40	7	1
Brant.....	1	1		1	1		5	3	
Bruce.....				10	5	1	16	10	
Carleton.....	1	1		3	1		10	3	
Dufferin.....				3	1		6	2	
Elgin.....	1	1		5	1	1	7		
Essex.....	1	1		7	5		17	6	1
Frontenac.....	1		1	1	1		16	2	
Grey.....				6	3	1	10	5	1
Haldimand.....				4	1		10	1	3
Halton.....				5	2		4	2	
Haliburton.....							10	2	1
Hastings.....	1	1		5	2		18	8	
Huron.....				9	3	1	17	8	2
Kent.....	1		1	8	3	1	10	5	
Lambton.....				6	5		9		
Lanark.....				5	3		13	4	
Leeds and Grenville.....				8	1	2	15	6	
Lennox and Addington.....				3	2		10	2	1
Lincoln.....	1	1		5			8	3	1
Middlesex.....	1	1		7	1	1	15	5	
Muskoka.....				4	1	2	16	7	1
Norfolk.....				5	3		9	6	
Northumberland & D.....				9	7	1	15	7	
Nipissing.....				4	2		14	1	1
Ontario.....				5	3	1	12	9	1
Oxford.....				5	2		11	7	1
Peel.....				3	1		5	2	1
Perth.....	1	1		5			11	5	
Peterboro.....				5	2		12	6	
Prescott and Russell.....				5	2	1	11	3	
Prince Edward.....				2	1		7	3	
Parry Sound.....				3	1		27	9	1
Rainy River.....				1			8		
Renfrew.....				4	1		22	11	
Simcoe.....				10	4		17	6	
Stormont, D. and G.....				8	3		11	5	
Thunder Bay.....				2			5		
Victoria.....				5	3		11	4	
Waterloo.....				8	4		5	4	
Welland.....				8	3		8	4	
Wellington.....	1	1		9	3	1	12	5	
Wentworth.....	1	1		2	1		8	4	
York.....	1		1	13			10	3	

The percentage of cities making returns is 100 and two only of the 13 registrars are not paid specially for their work.

The percentage of the towns and villages making returns is 46 per cent., and of this number 86 per cent. report they are paid fees, while the balance, 14 per cent., have their fees commuted.

The percentage of townships making returns, excluding those in the Territorial Districts, many of which are unorganized, is 44 per cent., while of these 92 per cent. report that they receive the fees in accordance with the statutory provision, 8 per cent. only, not receiving the fee.

It is difficult to form any accurate idea of what the proportion of those who receive fees is, in the municipalities not reported upon. It is a fair inference, however, that where a Division-Registrar has neglected to make a reply to a circular dealing with so important a matter, he is not always of this class most careful in his attention to this registration work. The fact, however, that the Division-Registrar is paid for every registration, in addition to the fact that in all township municipalities, the assessors are required to collect information regarding births and deaths during the year, further makes it a fair inference that the returns from these municipalities where the salary is not commuted, are more nearly complete than in the large centres.

It is quite evident, however, from the replies given in some instances, that where the salary of a town or city clerk has gradually grown to what may be called a living wage, the tendency appears to be to commute salaries no matter what extra duties are imposed upon the clerks by the Legislature. In order to in some degree accurately estimate the effect of these influences upon the returns, but especially upon the birth-rate, since it is the collection of birth returns which demands persistent endeavors on the part of the Division-Registrars, the following table is prepared of births in cities during the last 10 years.

Table showing Number of Births in Cities in Ontario from 1889 to 1898.
(From Assessors' Returns).

	Pop. 1889	Pop. 1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898
Toronto	139,452	186,517	4,946	4,774	4,739	4,436	4,153	4,210	4,131	4,246	4,078	4,122
Hamilton	44,299	51,011	1,130	1,036	1,176	752	1,109	1,028	1,086	1,128	969	1,102
Ottawa	41,000	55,386	1,726	1,908	802	729	1,089	864	888	1,198	1,273	1,349
London	26,786	38,575	568	511	605	616	604	573	574	599	552	627
Kingston	18,284	18,350	633	511	453	432	423	297	295	335	356	354
Brantford	13,384	18,009	349	330	331	350	349	314	370	340	408	387
St. Thomas	10,408	11,156	264	204	228	216	240	228	205	220	221	158
Guelph	10,413	10,892	262	204	235	237	249	240	228	240	259	246
St. Catharines ..	10,080	10,274	146	141	131	144	126	152	130	159	200	158
Belleville	10,105	10,183	213	185	157	154	146	142	148	143	151	169
Stratford	9,404	10,369	202	204	197	165	176	178	174	159	134	159
Windsor	9,041	11,334	240	181	269	252	303	256	243	257	237	229
Chatham	8,218	8,923	140	116	151	139	147	161	110	165	199	151
Total for each year	350,934	440,979	10,819	10,410	9,474	8,622	9,114	8,634	8,582	9,189	9,687	9,211

The broad fact is set forth in this table showing that over a period of ten years in a population estimated in the census year 1891 at 407,058 (or 395,229 by municipal returns), and during which ten year period the yearly municipal enumeration has shown an increase of 17.37 per cent., there has been an absolute decrease of births in the 13 cities from 10,819 in 1889 to 9,211 in 1898, or a difference of 1,608. Some of the cities show such marked variations in different years as in the case of Ottawa in 1889 and 1890, that it is evident some irregularity of registration from the normal existed.

Had the rate of increase of registrations from 1889 to 1898 been the same as that in population for the same period, 12,709 births would have been registered in 1898 instead of 9,211. If, however, the figures for different cities be examined it is apparent that no variation in the average yearly increase of population adequately explains such discrepancies as appear from year to year. While in two or three instances cities show an actual decrease in population of one or two hundred, yet the returns of births — as in

the case of Kingston — show such marked variations that we can only conclude that imperfect registration can account for such discrepancies. An enquiry into the particulars regarding the several cities gives us certain information of interest. Thus in Ottawa, Kingston, Brantford, Chatham, and St. Thomas, the Division Registrar has been changed during this period with results which in one or two instances may be seen in the returns. The tables show that in 11 instances the Division Registrars (Municipal Clerks) are paid specially for each return, and it may be supposed that their returns would be complete. That they are not so may be fairly inferred from the notable differences in different cities where populations have increased during the period.

Thus St. Thomas with an increase during the ten years of 613, shows a decline in the birth rate of 106 in the period: that is, the rate was 67 per cent higher in 1889 than in 1898. Again Kingston with a practically stationary population, has 279 of a decrease in 1898 as compared with 1889, the rate being 79 per cent higher in 1889 than in 1898.

In both these cities the Division-Registrar has changed during the period. In two other cities where the Registrars have not changed, St. Catharines and Stratford, the returns show no notable variations from year to year, yet the rate throughout the whole period is so much below the general average that only one conclusion is possible, viz; that a chronic neglect to obtain complete returns is apparent. Thus in St. Catharines there were but two years in the ten year period during which the deaths did exceed the births, these two being the first two years under the new Act, that of 1896. Perhaps, however, there is no better illustration of defective registration of births than in the city of Toronto. No change has taken place in the occupant of the office of Division-Registrar during this ten year period, and the population has increased by 47,065, according to the municipal returns. In spite of this fact, however, the births show an absolute decrease of 824, or there were 20 per cent more births reported in 1889 than in 1898. If, however, the population according to municipal returns be taken into the calculation, viz: an increase from 139,452 in 1889, to 186,517 in 1898, then had the rate in 1889 been maintained, there would have been 6615 births registered in 1898. In other words a relative decrease of 64 per cent has occurred in the birth rate of Toronto during the last ten years.

Such then is the situation of the statistics of births in our cities three years after the passage by the Legislature of the Act of 1896, which provides that Division-Registrars "shall use all available means to obtain the necessary information hereinafter required in this Act," and shall be paid 20c. for each return by the municipality; which further states that the parent or guardian of every child born in this Province, "or if there is no such person, then the nurse or midwife present at the birth" shall within thirty days from the date of the birth give notice to the Division-Registrar of such birth; while the Act further provides, "It shall be the duty of every qualified medical practitioner attending at the birth of any child born within this Province, to give notice thereof forthwith to the Division Registrar of the division in which the child was born."

Further comment on these results seems unnecessary. Until the Registrar-General is supplied by the city municipalities with returns approaching completeness, it is useless to attempt to draw any conclusions as to the causes of decreasing birth rates, or for the public to expect to find in the future in the Registrar-Generals Department records of returns which have never been made. What this means may be gathered from the fact that during 1899 there were 321 searches for births said to have occurred within the previous 30 years since the Registration Act was passed. Of these 321 searches, 96 were found not to be on record. It seems therefore, in case this number of searches of births occurring over this 30 year period should represent a fair average of registration, that a percentage of omissions amounting to 30 per cent has occurred throughout the period.

The remedy for this existing state of affairs is clearly indicated in the results of present methods. Wherever adequate payment for the work done, exists, the returns are relatively complete; and no payment to a city clerk of a single salary covering all duties laid upon him, has ever served to create in him such enthusiasm for collecting statistics as to make his returns complete. The authority which the Registrar-General of England exercises, of filling vacancies or replacing a Division-Registrar when his work has proved to be incomplete and unsatisfactory, seems to be demanded by the situation as it has been illustrated in the preceding study.

Marriages.

The total marriages recorded in 1898 in 777 municipalities and returned to the Registrar-General, were 15,375 as compared with 15,293 in 1897. This gives a marriage rate of 6.7 for the Province, or 0.1 less per 1,000 population than in 1897, its rate having been 6.8. Of the counties, 17 show an increase, while 26 show a decrease as compared with 22 which showed an increase in 1897. There seems to have been no general rule governing the increases and decreases as compared with the previous year. Thus, Carleton in 1897, showed a decrease of 19, and in 1898 an increase of 1; Essex, in 1897, showed a decrease of 52, and in 1898 an increase of 147. This latter rate of course, as mentioned in previous reports, is largely influenced by marriages of persons from the United States. An interesting series of increases is seen in a group of counties in Eastern Ontario, viz., Lanark, 51; Lennox and Addington, 17; Peterborough, 32; Prescott and Russell, 60; and Stormont and Glengarry, 20. An equally important group of decreases is seen in Western Ontario, viz., in Elgin, 36; Kent, 12; Lambton, 23; Middlesex, 69; Norfolk, 33; Oxford, 10; Lincoln, 38 and Welland, 20. Thus, with the single exception of Brant, with the small increase of 29, every county in the double tier of counties along Lake Erie, showed a decrease in the marriage rate amounting to a total of 261. A similar but less notable decline in the rate is seen to have occurred in Huron, with 63; in Bruce, 9, and in Simcoe, 11.

This decline, especially in the Lake Erie counties, seems to be general in regard to marriages; these having hitherto been assumed to be fairly well returned, and to be still more complete, since the amendment to the Marriage Act in 1897, requiring license issuers to forward to the Registrar-General copies of all licenses issued by them. No explanation of this uniform decrease, except on the supposition of alterations in the movement of populations, especially in rural districts, and therewith a variation in the age period of the resident inhabitants seems possible. The variation in the population of districts by age periods, has been frequently referred to in the reports of the Registrar-General of England, as affecting directly the marriage as well as the birth and death rates. In addition to this, however, it would appear that this decline in the marriage rate in Ontario is associated with a distinct tendency to delay marriage. As was stated in the Report for 1897:—

“Taken in conjunction with the following table of percentages of marriages in the several life periods by counties, this table affords evidence similar to that in other countries, that there is a distinct tendency to delay marriage; which means, necessarily that the proportion of marriageable persons in any community decreases with each semi-decade, and bears a close relationship to the question of a decreasing birth-rate.”

MARRIAGES IN CITIES.—The total marriages recorded in 1898 in the thirteen cities of Ontario, with a population of 441,360 was 4,589, or a total of 381 over 1897. The increases occurred principally in Toronto, with 195; Ottawa, with 118; and Windsor, with 90. Several cities showed a decrease, London having 30; Kingston, 40; St. Thomas, 7; Guelph, 23, and St. Catharines, 22. If these increases and decreases be compared with the population increase in 10 years, as shown in the table of births in cities on page 30, it will be seen that the cities with a decreased marriage rate, are cities with a practically stationary population during the period, and hence the law regarding age distribution of population becomes applicable as possibly explaining such decreases. There is reason, however, to believe that the causes which have been shown to produce defective birth returns, have been operative to some extent in the case of marriages as well. Thus London which showed a decrease of marriages in 1897 of 177, shows a further decrease of 30 in 1898; but by a recently received return for 1899, it shows an increase over 1898 of 71, or a total of 360 marriages for the year. It is interesting to note that the Registrar of London received for the first time fees for the work done in 1899.

As in former Reports it will be noted that the marriage rate in cities, as seen in table 2, is high as compared with the general rate, it being 10.3 per 1,000. If the anomalous rate in Windsor be separated from the balance of the cities, the marriage rate in cities may be considered as 9.0. While it is true that this rate should properly be further reduced by a percentage of non-residents who have gone to be married in neighboring cities, there is, however, as seen in all growing populations, the tendency for the

marriage rate to be higher in cities than in the more stationary rural districts and villages. Apart from these causes for variations from the average rate, there is the question of completeness of returns. An illustration, that of London, has been given of how every class of persons responsible for making returns is lax in reporting, in proportion to the indifference of the registrar; hence we are unable to believe that all clergymen systematically make returns of marriages celebrated by them. This supposition is proven by the results of a prolonged search for records of marriages for which licenses returned by the Registrar-General, were granted in 1897. The Registrar-General received during the year 12,153 marriage license cards from the various issuers and deputy issuers throughout the Province. After allowing a delay of six months so that all clergymen, registrars and issuers might send in their respective returns, a comparison was made of the licenses with the lists of marriages returned, with the result that 1,980 were found not to have been recorded in the municipalities where the licenses were issued. The Registrar-General thereupon issued a circular letter to each Division Registrar, giving the names of persons for whom a marriage license had been issued, but whose names did not appear in the marriage returns, and asked that enquiry and a reply regarding the matter be promptly made.

Much correspondence with license issuers, clergymen and others, resulted from this circular, explaining in many instances why certain marriages had not been returned. A common reply from clergymen was that the matter had been overlooked or forgotten; in a few instances the reply was that the lady had changed her mind before the ceremony was performed; while a still commoner reply was that the license was issued in one municipality, while the marriage had been celebrated in another.

It was a fairly satisfactory result of such a tedious search that the Registrar-General should have succeeded in obtaining 490 marriages, the recording of which would not have otherwise occurred. This amounted to 3 per cent. of the total marriages recorded. The work for 1898 is yet incomplete, but as a result of enquiries in nine counties, with the despatch of 104 letters respecting 248 marriages, 40 replies have been received regarding 72 marriages. To show how difficult it is to obtain complete statistics of this character, it may be mentioned that 35 returns of marriage licenses issued were made to the department from Frontenac in 1898 for which no corresponding marriages are found on record. These omissions occurred in nine municipalities; letters were sent to the registrars of each. Only three replies, covering eight marriages, were received, resulting in three marriages having been found recorded in some other municipality.

DISTRIBUTION OF MARRIAGES.—The distribution of marriages by months becomes a matter of some interest in connection with accuracy of returns. In 1898 as in other years, the month of December shows a large number of marriages to have taken place, being one-tenth of the total for the year. As the Act gives thirty days as the time for making a return, it is plain that a certain number of marriages celebrated in 1898 would be registered in 1899. The month of June, 1898, as in 1897, has fallen to second place, June returning the highest number of marriages in any month, it being 1,741; while May, as in several past years, returns 897, or the lowest in the year.

The relative number of persons by denominations who were married in 1898 will be found in table 8: This relative number is practically the same as for many years past.

Deaths.

The total number of deaths recorded in Ontario in 1898 was 26,370, as compared with 27,633 in 1897, being a decrease of 1,263. On a basis of population seen in table 1 this gives a death-rate of 11.5 per 1,000 or a reduction of 0.7 per 1,000 as compared with 1897. Of the 44 counties 12 only show an increase, while 32 show a decrease. Of those showing any notable increase, we have Perth with 77, Wentworth 87, Peterborough 30, Grey 35, and Dufferin 31. Of the decreases the principal are York with 300, of which 256 occurred in Toronto, Renfrew 145, Prescott and Russell 139, Huron 89, Bruce 67, Middlesex 63, Norfolk 52, and Stormont, Dundas and Glengarry 95.

There is reason to believe that the death returns are in a large measure complete, owing to the stringent laws against burial without a permit. It is gratifying to know that there is no county showing a great increase. Some instances may exist of an in-

crease due to improved registration, but a close examination of the table of deaths from different diseases may serve to explain an abnormal increase, owing to there having been an outbreak, as of diphtheria during the year.

The death-rate must be considered as showing an extremely satisfactory condition of the public health, especially in the matter of preventable diseases. That it is especially to this class of diseases that the reduction is due is seen in the fact that while in 1897 the death rate from small-pox, scarlatina, diphtheria, measles, whooping cough and typhoid caused 6 per cent. of the total deaths, this rate in 1898 was reduced to 5 per cent. of the total deaths. Or while the total reduction of deaths was 0.45 per 1,000 in 1898 as compared with 1897, the reduction caused by the decrease in preventable diseases is shown to have been 22 per cent. of this reduction, while in 1897 this class produced but 6 per cent. of the total reduction.

The distribution of deaths by Counties in 1898, as regards the rate per 1,000, shows much the same condition as in the several past years. Thus of the group of counties along Lake Huron and on the central plateau, viz—Bruce, Grey, Wellington, Halton and Perth,—all but Perth show a death-rate below 10 per 1,000. Further, it may be stated that the counties of Lincoln and Welland, with their clay lands and lower levels, again show a higher rate, but with a definite decline of 1.9 and 1.5 respectively per 1,000. The St. Lawrence counties of Stormont, Dundas and Glengarry, Leeds and Grenville similarly maintain their higher rate. They, however, likewise show a reduction of 1.4 in the first, while the latter is practically the same as in 1897. The seemingly high death rates in Algoma, Nipissing and Thunder Bay, as referred to in 1897, are accounted for by the irregular distribution of the recently increased mining population, shifting from year to year.

DEATHS IN CITIES.—In table 2 on page 30 will be found the death-rate for cities. The total deaths for 1898 was 6,894, as compared with 7,177 in 1897 and gave a death rate from all causes of 15.6, or a decrease of 0.8 per 1,000. Inasmuch as the population increases of the cities for the past decade, according to municipal returns, was 25.6 per cent, or 2.5 per cent. of an increase per annum, this reduction of the death-rate is gratifying. Four cities show a slight increase, viz—Hamilton with 73, London with 15, Guelph with 25, St. Catharines with 7, and Stratford with 17; while 8 cities show a decrease, these being Toronto 256, Ottawa 21, Kingston 6, Brantford 29, St. Thomas 40, Belleville 38, Windsor 11, Chatham 19. These results compare favorably with the progress made in the cities of other progressive countries. The following are the death rates for certain other cities in 1898:

Montreal.....	per 1,000.	London, Eng.....	18.7	per 1,000.
Halifax.....	"	Manchester, Eng.....	21.9	"
St. John.....	14.9	Boston, Mass.....	20.6	"
Winnipeg.....	12.1	Lowell, ".....	20.4	"
Vancouver.....	11.9	Providence, R.I.....	19.9	"
Leeds, Eng.....	19.3	Pittsburg, Pa.....	16.5	"
Birmingham, Eng.....	20.0	Buffalo, N.Y.....	12.88	"
Glasgow, Scot.....	21.2	Rochester, N.Y.....	12.32	"
Edinburgh, Scot.....	19.7	Albany, N.Y.....	20.1	"
Dublin, Ireland.....	26.8			

DEATHS BY CLASSES OF DISEASE.—In the adoption of the Bertillon system of classification of diseases, we are able to make for the first time a comparison with Michigan the only other State or Province which has published its returns for 1896, according to this classification. A comparison with a State situated geographically so similarly to Ontario, as Michigan is, with a climate and soil so alike, and a population composed of much the same elements, distributed as regard urban and rural populations in much the same percentage, is of extreme interest and importance. The population for Michigan in 1898, is given at 2,353,855 calculated on an arbitrary basis, which, if applied in Ontario, would bring the two populations to very nearly the same number.

The total deaths recorded in Michigan for 1898 were 29,474, giving an average death rate of 12.52 per 1,000.

Regarding the several groups, that of *Communicable Diseases*, including all those except tuberculosis, dealt with under the Public Health Act is of interest. The total in Ontario is 1,709, while the group in Michigan gives a total of 2,015, or 0.85 compared

with 0.75 per 1,000 in Ontario. The succeeding group of other *general diseases* which includes tuberculosis, gives 5,213 in Ontario as compared with 5,166 in Michigan. This is to some degree due to the inclusion of all deaths from marasmus, atrophy and anaemia, under one year of age, with tuberculosis in the Ontario returns. This total amounted to 311.

Of Diseases of the *Nervous System*, Michigan shews 3,963, as compared with 3,197, or a difference of .28 per 1,000.

Of *Diseases of Circulation*, Ontario shows 1,851, as compared with 2,540 in Michigan, or 0.81 as compared with 1.07.

Of the *Diseases of the Respiratory System*, the Ontario returns show 2,715 as compared with 3,236 or less by 0.18 per 1,000.

Of the Diseases of the *Digestive System*, Ontario gives 2,820 as compared with 4,106, a very notable difference in favor of Ontario, it being 0.51 per 1,000.

Of *Diseases of the Genito-urinary* class, the deaths in Ontario were 840 as compared with 1,452 in Michigan, or a difference of 0.24 per 1,000.

Of *Diseases of the Puerperal* class, the totals in Ontario were 245 as compared with 387 in Michigan, or more than one third less.

Of the group which includes *malformations, diseases of infants and diseases of old age*, the total in Ontario is 5,745 as compared with 1,960 in Michigan.

In this respect the Michigan returns show a noted improvement over the Ontario returns, and indicate a much greater accuracy in the return of causes of deaths, and hence of the classification of disease under the several special classes. In the Ontario returns, 2,915 of the total under this class occur under one year, and 2,763 over 70 years; while in Michigan, but 1,171 are given under one year, and 657 under senile debility.

It may further be stated that the notable difference in *Diseases of Circulation* in these reports may be due to heart failure in the Ontario returns occurring in persons over 70 having been placed in the class of diseases of old age. Under the *division of violence, including suicides and accidents* the Ontario returns give 1,091 as compared with 1,677.

Under the final classes of *Causes ill-defined*, Ontario has 850 as compared with 1,347 in Michigan.

DEATHS FROM SPECIAL DISEASES.—The diseases of the *Communicable Class* of greatest interest are given in the following comparative table.

Table of Deaths from Communicable Diseases.

Year.	County.	Smallpox.	Scarlatina.	Diphtheria.	Measles.	Whooping-cough.	Typhoid.	Malaria.
1897.....	Ontario .....	.....	169	976	80	167	355	38
1898.....	Ontario .....	.....	222	634	115	126	405	25
1898.....	Michigan.....	1	91	456	131	282	499	73
1897.....	New Jersey .....	.....	203	1,382	156	321	478	132
1897.....	New York	27	815	4,310	860	850	1,325	400
1898.....	Minnesota .....	.....	31	182	Notreturned	Notreturned	255	Notreturned

Compared with other areas of the continent in northern latitudes, that of the two land areas largely enclosed by the Great Lakes, viz., Ontario and Michigan, are seen to compare most favorably with the States of the Atlantic seaboard, as will be seen from the death-rates in New Jersey and New York. That the decline in the death-rate is not accidental but is due largely to the decline of communicable diseases—measles and whooping cough—is seen in remarks already made regarding deaths by counties.

The influence of climate and habits of life upon the mortality from communicable diseases is interesting, as seen in comparing deaths in Ontario with those in Scotland, the Argentine Republic, Cape Colony, and Jamaica. The population of the Argentine is distributed over 230,000 square miles, with an urban population of 362,082, and a rural population of 559,095. Adopting the census population of 1890 for calculation in the Argentine the following table is given.

Comparative Table of Deaths in Different Countries.

—	Smallpox.	Whooping cough.	Diphtheria and croup.	Typhoid.	Tuberculosis.	Anthrax.
Ontario 1898	.....	0 05	0.27	0.17	1 4	.....
Scotland 1898	.002	0.43	0.63	0.90	0 94	.....
					(Phthisis only.)	
Argentine Republic .. 1898	0.3	0.2	0.3	0.5	1.8	36 cases.
Cape Colony ... 1898	0.03	0.8	0.3	0.5	1.6	.....
Jamaica..... 1898	.....	0.18	.....	.....	1.6	.....

In the latter two countries the distinction between the coloured population and the whites is of great importance in estimating the relative healthfulness of climate.

MEASLES AND WHOOPING COUGH.—Measles show a mortality of 115, as compared with 80 in 1897; while whooping cough has decreased from 163 to 126. The type of both diseases would seem to be essentially mild as compared with that in Great Britain, where the rate in the great towns of Scotland was for measles and whooping cough respectively in 1897, 0.339 and 0.43 per 1,000.

DIPHTHERIA.—The total deaths from diphtheria and croup in 1898 were 634, as compared with 976 in 1897. There is no disease in which the progress of Preventive medicine has been more marked than in diphtheria during the past ten years. The following table of deaths in Ontario in successive years is illustrative:—

Table showing Deaths from Diphtheria and Croup in Ontario.

1887.....	1,786	1893.....	1,044
1888.....	1,489	1894.....	1,075
1889.....	1,101	1895.....	942
1890.....	893	1896.....	925
1891.....	955	1897.....	976
1892.....	890	1898.....	634

The remarkable falling off so pronounced in 1898 must doubtless be due to various influences, amongst which primarily may be placed the greatly increased knowledge amongst the people of its extremely contagious character, and the greater activity of the Local Boards of Health in suppressing outbreaks; secondly, to the seasonal influences peculiar to the year 1898; but especially to the greatly increased use by physicians of antitoxin, both in a curative and a preventive way. Comparisons with other states and countries have been made in previous tables, but the following reductions in deaths since 1884 in the various cities will especially illustrate the decrease due to the last cause, since the use of antitoxin in America only began with 1895, while in France and Germany it was much used in 1894:—

City.	1894.	1895.	1896.	1897.	1898.
New York.....	2,258	1,634	1,555	1,377	992
Boston	817	588	516	411	170
Chicago	841	1,775	955	702	622
Paris, France	1,109	421	444	298	259
Cities of Massachusetts, including Boston (pop. 1,611,780)	1,376	1,484	1,348	1,107	507
Berlin, Germany	1,361	934	515	507	608
London, Eng	2,670	2,316	2,683	2,263	1,772
Toronto	110	147	132	161	63
Hamilton	72	11	14	19	22
Ottawa	124	78	41	44	32
London	48	9	10	20	11
Kingston	5	26	21	12	3
Brantford	10	18	10	8	2
St. Thomas	1	8	19	12	3
Chatham	12	5	4	1	2

TUBERCULOSIS.—This disease shows a total of 3,291, as compared with 3,154 in 1897 or a death rate per 1,000 of 1.4.

As was stated in the report of 1897, the total deaths had then for the first time exceeded 3,000, and it was pointed out that a certain increase had been caused by placing atrophy and other wasting diseases of infancy under tuberculosis. The total deaths from tuberculosis or any of these found in the special tables under 10 years, is 587, so that there seems no doubt but that the total deaths from tuberculosis have increased. Indeed the monthly returns for 1899 gave for phthisis alone, 2,315 for a population of 97 per cent. of the whole Province.

Deaths from Consumption by age periods, Counties, 1898.

Counties.	Males.	Females.	Under 10	10-19	20-29	30-39	40-49	50-59	60-69	Over 70	Totals.
Algoma	14	13	3	4	9	5	2	2	2	.....	27
Brant	20	21	10	6	8	5	4	2	3	3	41
Bruce	42	40	11	12	22	19	3	6	6	3	82
Carleton	99	105	32	29	67	42	13	11	9	1	204
Dufferin	14	14	5	1	10	4	3	2	2	1	28
Elgin	28	30	6	8	17	8	6	9	3	1	58
Essex	27	48	12	10	19	9	14	7	3	1	75
Frontenac	44	48	8	6	23	26	13	6	8	2	92
Grey	39	51	10	8	28	23	9	8	4	.....	90
Haldimand	9	16	2	5	3	4	5	2	3	1	25
Halton	12	12	6	1	10	2	3	.....	1	1	24
Haliburton	4	3	1	.....	.....	2	4	.....	.....	.....	7
Hastings	32	46	8	12	18	12	12	6	6	4	78
Huron	32	45	15	6	22	16	7	5	5	1	77
Kent	40	48	10	14	26	20	10	3	3	2	88
Lambton	32	30	6	3	19	13	10	4	4	3	62
Lanark	30	31	8	4	23	9	5	7	2	3	61
Leeds and Grenville	63	69	20	20	33	24	14	15	3	3	132
Lennox and Addington	19	19	7	5	12	7	3	3	.....	1	38
Lincoln	25	22	6	4	11	13	5	2	4	2	47
Middlesex	69	66	28	17	34	19	14	13	7	3	135
Muskoka	10	9	3	2	6	6	1	1	.....	.....	19
Nipissing	10	13	6	4	5	1	4	1	2	.....	23
Norfolk	13	23	8	3	9	9	.....	2	2	2	36
Northumberland & Durham	47	50	21	7	30	18	12	6	3	.....	97
Ontario	30	37	11	7	19	15	6	5	2	2	67
Oxford	37	35	9	7	21	13	9	5	8	.....	72
Parry Sound	15	17	6	4	6	4	4	4	2	2	32
Peel	13	22	3	4	8	4	10	3	1	2	35
Perth	50	46	17	5	27	17	13	9	7	1	96
Peterboro	37	32	13	8	19	11	9	1	5	3	69
Prescott and Russell	26	33	6	8	24	5	5	3	4	4	59
Prince Edward	10	14	1	5	4	5	5	2	2	.....	24
Rainy River	4	11	5	2	3	.....	4	.....	1	.....	15
Renfrew	14	34	1	17	10	13	3	1	2	1	48
Simcoe	36	69	9	13	36	23	15	3	3	3	105
Stormont, D. and G.	47	69	10	14	39	22	15	5	7	4	116
Thunder Bay	5	2	.....	1	3	.....	2	.....	1	.....	7
Victoria	20	30	8	10	11	10	3	2	4	2	50
Welland	22	24	7	6	5	8	5	3	1	1	36
Waterloo	21	32	13	5	12	5	10	5	2	1	53
Wellington	33	34	10	7	17	13	8	1	7	4	67
Wentworth	71	69	32	13	34	29	15	5	7	5	140
York	278	276	174	53	123	96	56	29	15	8	554
	1,543	1,748	587	330	885	609	373	209	166	82	3,291

The distribution of the disease by counties illustrates a peculiarity of phthisis, viz., that it shows, owing to its widespread and chronic character, both the great permanency of local conditions, such as undrained soils and old houses where previous cases have been, as well as the continued residence of the same families in the old-settled fertile agricultural sections of the Province, members of which may have

previously have died of the disease. This may be illustrated by the following table, giving the deaths for ten years in the County of Huron, in which the numbers of persons dying, having the same family name are set by number.

Total deaths in Huron County from Tuberculosis in 1889-1898—633.

Total family names occurring more than once, 115 or 18.1 per cent.

Total persons dying whose names are those which occurred more than once, 208 or 47 per cent.

Total times repeated names occur on average, 2.6.

Family names repeated :—

60	names twice.
25	" three.
10	" four.
2	" five.
6	" six.
1	" eight.
1	" nine.

This is evidence next in value to an actual house to house census, such as that made in New York City in 1886 ; a kind of evidence of supreme value in estimating the causes of the increase of the disease.

That it is in the more newly settled areas of the Province that the lower mortality prevails, due probably to the causes indicated above, is seen roughly in the following table giving by census years the mortality in several groups of counties in the Province.

Table showing deaths from Tuberculosis in certain Counties in 1871 and 1898, with Population, illustrating periods of permanent settlement.

County.	Year.	Population.	Death rate.
Brant	1871	32,250	1.0
	1898	39,109	1.0
Welland	1871	25,761	1.5
	1898	32,369	1.1
Leeds and Grenville	1871	57,918	1.22
	1898	65,339	2.0
Prince Edward.....	1871	20,336	1.0
	1898	20,265	1.2
Huron	1871	66,165	0.54
	1898	91,664	1.0
Bruce.....	1871	48,515	0.20
	1898	69,328	1.2
Simcoe	1871	64,248	0.40
	1898	76,974	1.4
Waterloo	1871	40,251	1.5
	1898	54,168	1.0
Oxford	1871	48,247	0.93
	1898	53,493	1.35
Middlesex	1871	82,595	0.6
	1898	109,417	1.25
Norfolk	1871	30,763	1.20
	1898	33,256	1.10

DEATHS IN CITIES.—The total deaths in the cities from tuberculosis are seen in the following table to have increased in absolute numbers during the ten year period by 40 per cent. Whether this represents an actual increase depends, however, on the relative completeness of returns in the earlier years of the period, with the inclusion of deaths under one year in the returns for 1898. An additional allowance must be made for an increased population, estimated at 25.6 per cent in the ten years.

Deaths from Tuberculosis by Cities, 1889 to 1898

	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.
Toronto....	303	387	420	477	512	442	430	442	467	483
Hamilton....	80	88	90	73	88	80	104	100	83	109
Ottawa.....	102	106	53	80	111	98	91	109	134	148
London.....	27	38	52	43	42	54	51	61	52	64
Kingston....	51	39	42	39	35	33	27	41	54	45
Brantford....	18	15	22	26	32	19	26	31	25	23
St. Thomas....	11	12	15	13	9	12	15	19	17	13
Guelph.....	11	8	10	16	23	17	15	15	14	21
S.O. Catharines.	26	27	12	27	18	23	21	17	15	21
Belleville....	25	16	14	25	17	13	24	11	20	15
Stratford....	15	16	8	9	11	16	8	12	13	19
Windsor.....	16	16	28	13	17	21	21	21	17	23
Chatham.....	16	22	17	11	14	13	7	18	12	14
Total....	701	790	792	852	929	841	840	897	923	998

There certainly has been no decrease in Ontario such as has marked the cities of Great Britain during the past thirty years, which have made in spite of their enormous populations, such great advances in the problem of the housing of the poorer classes. As yet no systematic steps have been taken by local boards in the cities of Ontario to maintain a supervision of houses where consumptives are resident, nor to disinfect the premises after death.

DEATHS FROM TUBERCULOSIS BY OCCUPATIONS.—An attempt has been made to classify, with all the accuracy possible, the deaths from consumption by occupations in counties. (See table 16, p. 48).

The table is of great interest as showing the distribution of population in different counties varying greatly in its proportions in urban and rural districts. A glance at the table makes it at once plain that a number of occupations, or persons in certain social positions in life, supply a large proportion of the deaths.

That there are notable variations in the distribution of population as regards both age and sex in different municipalities, may be illustrated by the following, showing the number of deaths by age and sex in Huron county in 1898. The returns show 72 deaths due to tuberculosis, and arranged as above, they are:

Age	(Under 10)	(10-19)	(20-29)	(30-39)	(40-49)	(50-59)	(60-70)	Total.
Male.	1	4	5	5	4	3	4	26
Female.	3	9	17	9	3	3	2	46

The first notable fact here seen is that there are practically two deaths of females for every one male. Further, the preponderance of females beginning in the 10-14 year-period, is maintained until child-bearing has practically ceased at 40 years. Making due allowance for the migration from a county largely rural of a portion of the male population, there would seem, however, to exist some other specially potent cause, such as more constant indoor life, possibly in an already infected house, to account for this relatively great preponderance of female deaths. In table 16 it will be further seen that the second largest total is that of farmers, 354—the largest being that of housewives, 693. If from the class of housewives we select an equal number of deaths of females as of males belonging to the farming class, we have 708, or more than 21 per cent. of the total deaths are farmers or farmers' wives. Hence, taking a probable estimate of the number of farmers and farmers' wives in Ontario, the rate in this class stands high, being probably nearly 1.5 per 1,000. Under the class children, there are 471 deaths, and allowing for a proportion of those with occupations not given, this will include those set down in the table according to ages as dying up to ten years, or 587 in all. The next highest class is that of laborers, the deaths being 193. Under the heading of spinsters is necessarily classed a large number of women of marriageable age; since in the table by ages the total deaths between 20 and 40 are 1,494, which includes persons of both sexes, married and single. A further proportion are included in the period between 15 and 20 years. The next highest class is servants, being 51, most of whom are naturally females. Of the large class under the heading of clerks, there appear 45 deaths, which is, however, almost equalled by students, their number being 42. Pro-

portionately to their total number, the deaths in this class with sedentary lives would appear highest of all.

Amongst the occupations of those showing relatively the highest mortality, are those of school teachers and painters. The total teachers in the public and separate schools of Ontario was in 1899, 9,209, so that the death rate is 2.17 per 1,000. Remembering the chronic nature of this disease and the fact that many teachers continue at their duty for months while in failing health, we see that such a mortality has a direct bearing upon the health of the school children.

The figures are not available regarding the total printers employed in Ontario, but the fact would appear that 20 of a mortality is very large compared with most other occupations for the number employed. Perhaps, however, the mortality amongst barbers is even greater proportionately to the number employed, there being 16 in all. The fact of this class, like teachers, coming into close contact with other persons, and handling cutting tools which may be infected from sputum, while, as often is the case, many abrasions of the skin are made by them, becomes so important a matter as would seem to demand some method of dealing with the danger.

Tabular Statement of Returns and of Correspondence in 1899.

Receipt of schedules containing Annual Records and certificates for same	750 Division Registrars.
	27 District Registrars.
Returns for 1898, indexed and compared.....	Births, 46,599
	Marriages, 30,750
	Deaths, 26,370
Receipt and filing of Marriage Licenses	13,990
Issued to Division Registrars :	
Blanks for returns, Forms A, B, C	
Form B (Burial Permits)	
Form D (For Licenses)	
Blanks for Cemetery Returns	194,500
Permits, by letter, to register Marriages, not received in former years.....	137 { B, 77
	M, 58
	D, 2
* Application for Searches of Records for Births.....	355
Marriages	113
Deaths	377
Certificates issued for Record— Births.....	169
Marriages	74
Deaths	157
Total fees received for 755 searches	\$188.75
400 certificates	\$200.00
Registration in Supplementary Index of returns not previously recorded	
in their proper year	Births, 1,253
	Marriages, 305
	Deaths, 56
Comparison of Marriage License Returns received with Marriages recorded by local registrars.....	12,153
Marriages (for which license was issued) not found in the municipality where license was issued.....	1,980
“ “ found registered in other municipality.	1,490
“ of persons (3 per cent. of whole) found by correspondence.....	980
Number of letters received and filed in 1899	1,902
“ “ written, sent out and filed	1,358
Comparison (not previously made at time of indexing) of indexes with Schedules for parts of 1889-1890.....	79,022
All of which is respectfully submitted.	

PETER H. BRYCE,
Deputy Registrar-General.

Inspector's Report.

TORONTO, January 2nd, 1900.

TO THE HONOURABLE J. R. STRATTON

Registrar General of Ontario :

SIR,—I have the honor to report that during the past year I visited for purposes of inspection the Division Registrars of municipalities within the counties and districts of Algoma, Frontenac, Halton, Hastings, Huron, Lennox, Lincoln, Leeds & Grenville, Middlesex, Muskoka, Northumberland & Durham, Nipissing, Parry Sound, Thunder Bay, Rainy River, Peel, Perth, Simcoe, Stormont, Wentworth and York. The following summary of a number of places visited will give a fair idea of how the Registration Act is carried into effect throughout the Province.

In the City of London I find the physicians make scarcely any pretence of registering births, and few of them even obtain the cards necessary for the purpose from the Division Registrar. The returns are almost invariably made personally by some member of the household, and it is clear that many births take place which are not reported at all. In marriages the returns appear to be pretty complete, as the clergymen of the city as a rule are very careful in making their reports. As to deaths, the Division Registrar assures me he is satisfied he gets practically all the returns, but the death rate is so low that I question very much whether his opinion is correct.

The physicians are fairly good in sending reports of deaths to the Division Registrar, but scarcely ever to the Medical Health Officer, as the Act calls upon them to do. Undertakers claim to be very careful in refusing to bury without the necessary permit, but some caretakers of cemeteries will inter the body without even asking for the burial permit. London is typical of a great many municipalities in Ontario. The registers are well kept, the records are sent to this Department in excellent form and at regular stated intervals, and the Registrar is most anxious to have his returns as full as possible not only for the credit of the thing but that the fees may bring him a larger gratuity, but yet it is a self evident fact that the returns are not nearly complete. We now take the city of Stratford, and here I regret to say I cannot even compliment the Registrar upon the mechanical portion of his work, as his returns are not sent in until long after the close of each year; while as to births, which were recorded in 1898 as 159, I found by an actual canvass among the medical practitioners that they amounted to at least 90 more, and consequently the low birth rate of 15 per 1,000 as shown in the schedule was increased to at least 24. Here again the physicians have in the past given no help to the Registrar, but all of them have agreed to endeavor to carry out the Act in the future. Next year's report will tell how these promises have been kept. I am pleased to be able to state that, from information received from the undertakers, I find the number of deaths recorded are pretty nearly correct, which fact goes to prove that Stratford must be a very healthy city.

In St. Catharines we find the same trouble in regard to birth records, few of the physicians making any returns whatever, while I have every reason to believe that the death returns are as complete as they can be made. The Registrar is a most painstaking official, and yet we have the anomaly of his returns showing frequently a larger number of deaths than births.

In Hamilton, although the physicians again fail to make returns of births to any great extent, we find the birth rate to be a fairly large one, and in fact all the records seem to be pretty complete, as the Registrar appears to have the citizens well in hand in this respect, and they seem to have got into the right swing.

In Kingston the deaths appear to be very complete, but it is quite evident the births are not nearly all recorded, and here again a great many of the physicians appear to be utterly oblivious of the fact that upon them devolves the duty of making returns. The Division Registrar however reports a great improvement in this respect.

In the Town of Cornwall registration matters appear to be on a very satisfactory basis, and I am convinced the records are practically perfect, the ratio being high both in

births and deaths. Of course there being a considerable French-Canadian element among the population will account to some extent for this, but the Division Registrar has given a great deal of attention to the work, and has imbued all classes of the community, even the physicians, with the idea that the Registration Act is a reality and that its provisions should be carried out as fully as possible, and consequently his returns are thoroughly reliable.

In Brockville much the same result is obtained by the same means. The Division Registrar uses every means in his power to get complete returns, and his earnest endeavors in this respect meet with a ready response.

In these last two towns the physicians render very great assistance to the Registrars, and consequently much fuller returns are obtained. In the neighboring town of Gananoque the reverse is the case, and the almost inevitable result follows: viz, much smaller returns.

We will now take a few towns in the north-western and northern districts of old Ontario, beginning with Goderich, where the Division Registrar states that "the Doctors do not report births," and the result is the returns are very low, being only 14 per 1,000 population. On the contrary they are particular in making death returns, and we find the ratio in this respect has increased in two years from 7.5 to 11.5. In Clinton much the same state of affairs exist, and the birth rate is stationary at 16 per 1,000 while the death rate is 11.5.

In Blyth the birth rate has fallen from 20 in 1896 to 10 in 1898, the death rate having in the meantime gone up from 8.5 to 10.

In Orillia town again we have the old story of no birth returns from physicians, and a decrease from 17.5 to 14 is recorded in two years, the death returns being much smaller than they should be as well.

In the rural municipalities, even to a greater extent than in the towns, much depends upon the individuality of the Division Registrar whether the returns are to be large or small, consequently the discrepancies between the different returns are very noticeable. In Pittsburgh township the birth rate is fairly high, being above 24 per 1000, while in Kingston township, immediately adjoining, the records show only 12.5. It seems scarcely possible that such a great difference should actually exist where the circumstances are so nearly alike. The death rate is practically the same in each municipality, being 14 in Kingston and 14.5 in Pittsburgh, which I should judge in both cases is pretty nearly correct.

In Caledon township the birth rate is low, being only 16 per thousand, though the Division Registrar thinks he gets nearly all the records; but his death returns show only 6.5 per 1,000, which is probably not one half of the actual occurrences. The fact of there being seven burying grounds in the township without caretakers probably accounts for many burials taking place without permits being obtained. This shows one of the many difficulties in the way of complete registration returns.

In Huron county East Wawanosh township shows the birth records to be 32.5 per 1000 in 1896 and 28 in 1898, while Morris township only claims 18.5 in the former year and 14 in the latter, evidently away under the actual reality. The deaths in both cases show an average of about 10.5, which, after careful enquiry, I am inclined to accept as about correct, as the returns from all the townships in that part of the country indicate a low death rate throughout the district.

In the newly settled parts of the Province known as New Ontario the returns are considerably higher than in the older sections, especially in respect to the birth records; but I have no reason to think that it is on account of more complete registration. Wherever the French-Canadian element is much in evidence, and this is the case throughout Nipissing, Algoma, Thunder Bay and Rainy River Districts, the birth rate is invariably large. A few instances will suffice to show the truth of this statement. In Balfour township for 1898 the births returns showed 60 per thousand, in Hallam 50, in Salter and Wray 50, in Nairn and Hyman 60, in Rayside 40, in Bonfield 50, in Caldwell 50, in Ferris 50, in Mattawa 50, in McKim 50, in North Bay 50, in Papineau 40, in Springer 50, in Sturgeon Falls 50, and in Sudbury 50. Were it not for these high figures and the returns from Essex and Prescott and Russell counties the birth rate of the Province would indeed appear very small. Among the other municipalities in-

spected were the following, viz: Toronto, Cobourg, Port Hope, Belleville, Napanee, Hope Township, North Fredericksburgh, Brampton, Sault Ste. Marie, Wingham, Orillia Township, Oro, Gravenhurst, Machar, Lount, Laurier, Port Arthur, Fort William, Oliver, McIrvine, Alberton, Rat Portage, Keewatin, Turnberry, Wroxeter, Day Mills, Neebing, Schrieber, Mikado Mine, Regina Mine, Wabigoon, Dryden, Van Horne, Burlington, Toronto Junction, Weston, North Toronto and Etobicoke.

The following table shewing the birth and death returns from a few municipalities in each county of the Province, for the years 1893, '96 and '98 is well worthy of perusal as the eccentricities apparent upon its face, give a pretty fair indication that a great improvement must be made before our vital statistics can be looked upon as at all reliable.

	Births per 1,000.			Deaths per 1,000.		
	1893.	1896.	1898.	1893.	1896.	1898.
BRANT.—Oakland	19.	14.	10.	20.	4.	10.
Brantford	22.5	20.5	23.	15.5	16.	13.
BRUCE.—Eastnor Tp	33.	45.	31.	5.5	17.	6.5
Walkerton	23.	21.	12.	14.5	10.	12.
Paisley	24.5	15.	8.	13.5	10.	5.
CARLETON.—Gloucester	38.	36.	33.	21.	17.5	21.
Gower, North	6.5	13.	9.	2.5	7.5	12.5
Huntley	9.	31.	21.	3.	11.	9.
Hintonburg ..	—	54.	50.	—	25.	20.
DUFFERIN.—Garafraxa, E..	34.	20.	17.	11.	10.	8.
Orangeville	10.5	12.	9.5	13.	9.	8.5
Shelbourne	23.	21.	25.	9.	15.	16.
ELGIN.—Dorchester, S.	24.	23.5	18.	16.	8.5	9.
Dunwich	11.	11.	19.	5.5	8.5	16.
Aldborough	18.	18.	18.	9.5	7.	8.5
ESSEX.—Rochester	45.	46.	37.	16.	23.	17.
Windsor	30.	22.5	19.	18.5	14.5	13.
Essex	15.	17.	17.5	6.	12.	11.
FRONTENAC.—Bedford	33.	20.5	33.	15.	18.5	11.5
Kingston	18.	12.5	12.	6.5	12.5	14.
Storrington ..	13.5	25.	8.	8.	12.	9.
GREY.—Derby	27.	20.	25.	20.	14.	16.
Proton	33.	28	32.	13.	8.	10.5
Collingwood Tp.	13.	8.5	11.	4.5	8.5	10.
HALDIMAND.—Rainham	27.	25.	25.	7.5	10.	15
Dunn	20.	15.	14.5	7.5	1.	20.
Cayuga	28.	22.	15.	20.	9.	6.
HALTON.—Milton	30.	25.	20.5	10.	16.	13.
Georgetown	14.5	22.	18.	8.	10.	13.
Oakville	22.5	15.5	20.5	11.	12.5	10.5
HASTINGS.—Madoc	8.	12.	8.	2.5	5.	3.
Monteagle	37.	40.	38.	7.	11.	9.5
Belleville	14.	13.5	16.5	15.	15.	15.5
Deseronto	26.	23.	35.5	10.	9.	12.5
HURON.—Hullett	26.	24.	22.	13.	8.	10.
Ashfield	24.	25	16.	5.5	10.	10.
Goderich	14.	13.5	14.	5.5	7.5	11.5
KENT.—Dover	36.	38.	36.	11.	10.5	14.5
Chatham	8.5	19.5	21.	4.5	9.6	11.5
Blenheim	25.	22.5	14.5	19.	9.	16.5

	Births per 1,000			Deaths per 1,000.		
	1893.	1896.	1898.	1893.	1896.	1898.
LAMBTON.—Euphemia	28.	18.5	19.	14.	5.	9.5
Sombra	12.	25.	20.5	6.	7.	22.
Watford	32.	20.5	18.	21.	16.	8
LENNOX.—Sheffield	30.	28.	21.	15.	12.5	16.
Richmond	5.5	13.	19.	6.	11.	16.
Fredericksburg, S	9.	10.	7.5	4.	8.5	8.5
LINCOLN.—Caistor	26.	26.5	21.	9.	12.5	12.
St. Catharines ..	13.	16.	16.	17.5	13.5	17.
Niagara	18.5	15.5	20.5	7.	7.5	6.5
LANARK.—Lanark	30.	27.5	30.	15.	19.	9.
Smith's Falls	13.	12.	14.	2.5	7.	15.5
Montague	1.	13.	12.5	1.5	5.	10.5
LEEDS.—Crosby, N	25.	25.	38.	10.	10.5	15.5
Oxford	8.	19.5	15.	5.5	17.5	11.5
Gananoque	12.5	15.	17.5	3.	8.	11.
Elmsely, S.	15.5	15.	18.	11.	2.5	10.
MIDDLESEX.—Dorchester, N.	24.	24.5	26.5	11.	12.5	14.
Westminster ..	17.	11.5	13.5	11.5	9.	9.
Metcalf	15.5	18.	23.5	7.	7.	3.
NORFOLK.—Houghton	21.	31.	29.	13.	16.	13.
Townsend	21.	20.	17.	7.	10	9.
NORTHUMB'LAND.—Alnwick.	33.	30.	33.5	20.	18.	19.5
Cavan	11.5	23.5	13.	7.5	6.5	9.
Campbellford ..	19.	16.5	21.5	2.	10.5	13.
Monaghan, S ..	24.	25.	41.	15.	5.	22.
ONTARIO.—Rama	35.	35.	30.	19.5	15.	20.
Mara	9.	17.	14.5	4.	11.5	7.
OXFORD.—Blandford	28.	20.	23.	14.	10.	15
Oxford, N.	12.	22.5	18.5	15.	15.	7.5
PEEL.—Caledon	21.	16.	16.5	4.	6.5	6.5
Streetsville	25.	25.	12.	15.	15.	15
PERTH.—Ellice	27.5	20.5	20.	12.5	8.	15.5
Blanshard	8.5	12.5	19.5	5.5	6.5	6.5
Mitchell	25	24.5	18.	9.	12.5	21.
PRESCOTT.—Alfred	46.	45	52.	22.	20.5	16.5
Caledonia	10.5	27.	25.	5.5	7.5	14.5
Hawkesbury ...	46.	14.	35.	11.	7.	17.5
L'Orignal	nil	17.	23.	3.	8.5	4.
PETERBOROUGH.—Belmont ..	12.5	21.	32.5	5.	9.5	15.
Harvey	34.	40.	22.	7.5	5.	12.
PRINCE EDWARD.—Athol ...	27.	17.5	16.	12.	17.5	11.5
Sophiasburgh ..	16.	22.	21.	7.	17.5	11.
Marysburgh, N.	15.5	17.5	10.	15.	7.5	10.
RENFREW.—Hagarty	40.5	21.5	22.5	17.5	6.5	8.
Arnprior	18.	49.	38.	9.5	16.5	13.5
Westmeath	17.	19.	15.	17.5	3.	5.5
SIMCOE.—Medonte	34.	31.5	33.	9.	7.5	7.
Essa	8.	14.	7.5	3.5	7.5	8.5
Adjala	7.	4.	12.5	6.	4.	7.
STORMONT.—Winchester ...	30.	31.5	25.	13.	13.	11.
Lancaster	7.	18.5	13.	2.5	6.	8.5
Cornwall	24.	36.	30.	17.	17.5	19.
Iroquois	4.	10.	8.5	5.	5.	20.

	Births per 1,000			Deaths per 1,000.		
	1893.	1896.	1898.	1893.	1896.	1898.
VICTORIA.—Mariposa.....	26.	25	23.5	14.	17.5	14.
Emily.....	5.5	11.	12.	8.5	13.	10.5
WELLAND.—Bertie.....	29.	20.	18.	7.5	8.5	12.
Pelham.....	14.5	18.5	15.	11.	11	13.
Welland.....	22.5	15	16.5	13.	6.5	14.5
WATERLOO.—Woolwich....	35	30.	29.	9.	13.	7.5
Dumfries, N..	21.5	21.	20.	6.5	7.	8.5
Berlin.....	28.5	22.5	24.	13.5	13.5	13.5
Galt.....	23.	18	15.5	10.5	9.5	13
WELLINGTON.—Garafraxa, W	28.	26.5	38.	13.5	7.	10.5
Arthur.....	16.	10.	10.	3.	11.	7.
Luther, W..	21.5	29.	23.5	8.5	2.5	8.
WENTWORTH.—Ancaster...	25.	26.	23.	16.	11.5	11.5
Hamilton.....	23.5	22.5	22.	15.	14.5	15.
Flamborough, E	22.5	26.	20.	10.5	7.	12.
YORK.—Etobicoke.....	29.	25.5	21.	18.5	16	19.
Richmond Hill....	8.	16	20.	2.	14.	9.5
Aurora.....	19	11.5	14.5	10.	10.5	10.
Whitchurch.....	24.	25.	22.	10.	8.	5.

I include no returns from any of the outlying districts in the foregoing summary, but confine myself to those portions of the Province where the Registration Act has been in force for a period of nearly a third of a century, and yet we find within the past six or seven years such a glorious irregularity attached to these returns that they are practically rendered useless as a basis of calculation. The birthrate, it will be seen, runs from 54 per thousand to actually nothing, while the death rate shows 26 as the highest and 1 as the lowest. Of course no fair comparison can be made between what might be termed the "extreme sections" of the Province as both the births and deaths actually taking place are much greater in some places than in others, but in the following municipalities a retrograde movement to an alarming extent seems to have set in. In Nepean township the recorded death rate has fallen from 26 to 10; in Paisley village the birthrate from 24.5 to 8, the death rate from 13.5 to 5; in Walkerton town the birthrate from 23 to 12; in Eastnor township the birth rate from 45 to 31, the deathrate from 17 to 5.5; in Oakland township the birth rate from 19 to 10, the deathrate from 20 to 10; in Storrington township the birth rate from 25 to 8; in Cayuga village the birthrate from 28 to 15, the death rate from 20 to 6; in Watford town the birthrate from 32 to 18, the deathrate from 21 to 8; in Blenheim town the birth rate from 25 to 14.5, the death rate from 19 to 9; in Ashfield township the birth rate from 25 to 16; in Turnberry township the deathrate from 16.5 to 8; in Lanark township the deathrate from 19 to 9; in Streetsville village the birth rate from 25 to 12; in Oxford North township the death rate from 15 to 7.5; in Westmeath township the death rate from 17.5 to 3; in Bertie township the birth rate from 29 to 18; in Hagarty township the birth rate from 40.5 to 21.5, the death rate from 17.5 to 6.5; in Athol township the birth rate from 27 to 16; in Galt town the birth rate from 23 to 15.5; in Arthur village the birth rate from 16 to 10; in Etobicoke township the birth rate from 29 to 21. In a few instances I am pleased to say a steady improvement is noticeable, but on the whole what strikes the observer most forcibly is the great uncertainty which pervades the returns from year to year, they may be pretty nearly correct or they may be so far astray that "he who runs may read" how wide of the mark they actually are. The birth rate of old Ontario is certainly a low one at best, but from careful observation I am inclined to think that fully 25 per cent. may be added to the recorded returns throughout the whole Province in order to make them approximately correct. As to death returns in many localities they are so nearly complete that probably

an addition of fifteen per cent. to the total number received by the Department would bring the records up to the actual reality. In regard to marriage returns I have little complaint to make as it would appear they are pretty fully recorded in every section of the Province. After an experience of nearly four years with the amended Registration Act I regret to say that the hopes expressed in my report of 1896 "that before the closing years of this century the vital statistics of Ontario will be very reliable and pretty near complete" has by no means been gratified. For a couple of years immediately succeeding the passing of the amended act a great improvement was noticeable in nearly every respect, so that I felt satisfied the problem of complete registration was shortly about to be solved. But the efforts of the Division Registrars as far as *quantity* is concerned seems to have been of a spasmodic nature, as the returns which in 1897 reached high water mark fell off lamentably, excepting in marriages, in the following year, and from present indications I fear that when all the schedules are received for 1899 a still further shrinkage will be noticeable in the birthrate. To a certain extent this is accounted for by the fact that for some little time after the passing of the amended act there was a tendency to register births and deaths which had occurred some years previously and had not been registered up to that time, but this would not mean one-half of the decrease shown in 1898. It would seem that the very fact of the publicity given to the question of vital statistics by the discussion upon the amendments to the act had for a time a most beneficial effect, and had awakened the people to the necessity of making returns, but alas that awakening was of short duration and they appear to have fallen into a still deeper sleep. As far as the clerical work is concerned I am pleased to note a steady improvement on the part of the Division Registrars and comparatively few schedules have now to be sent back for correction.

In looking for reasons for the defective registration of births and deaths several very cogent ones present themselves. In the first place we know that "what is everybody's business is nobody's business," and when the ordinary citizen learns the number of people who are called upon to see that the proper registration is made he is apt to decide to "leave it to the other fellow." As a matter of fact householders have frequently told me that they thought that the doctor was sure to make the return, while physicians, almost to a man, feel certain the record will be made by the householder.

In marriages the clergyman alone is made responsible for the proper information being given, and these records are certainly by all odds the most satisfactory obtained by the department.

It is probably necessary that more than one party should be called upon to see that births and deaths are registered, but at the same time that very fact is certainly one of the obstacles in the way of complete returns. Then we find that the quarter from which we can and should receive the greatest assistance is practically of no use to us whatever.

It is with regret that year after year I have been forced to report that the physicians scarcely give any assistance to the Division Registrars in regard to birth and death returns. Whatever the profession as a body may understand of the Act it is clear that individually very few medical practitioners feel themselves bound by any of its provisions. After nearly four years existence of the section making it imperative for "every qualified medical practitioner attending at the birth of any child born within this Province to give notice forthwith thereof to the Registrar of the Division in which the child was born," We find it is observed chiefly in its breach, and many doctors are not aware to-day that such a section is in the Act. An equally strong paragraph relating to their duties in connection with the registration of deaths is also ignored to a great extent throughout the Province. Referring to the physicians in this connection in my report of 1891 I then stated: "I regret to say that as a rule they simply do not do their duty, and when such an intelligent and highly educated class fails to carry out the law it can scarcely be expected that 'the masses' will comply with it in every respect." What was true then is unfortunately almost equally true to-day. Educating the profession to do work in which they take such little interest makes slow progress in Ontario.

We will now consider the position of the Division Registrar which as the Act provides is filled by the Clerk of each municipality. I desire to again place on record my opinion that as a rule these officials are active and intelligent men who are painstaking

and energetic in their capacity as *Municipal Clerks*, but they are with few exceptions very much underpaid for the work they are called upon to do. It is surprising to learn even in comparatively wealthy municipalities how meagre their salary really is, while in many of the smaller townships they receive a mere pittance for work that certainly is of considerable importance. Under these circumstances these gentlemen do not feel very much like devoting time or attention to the duty of collecting vital statistics. In cities and towns their time is principally taken up with their municipal work, while in townships the area is so great which they have to attend to that it is a most difficult matter to secure complete returns. Then again, the work connected with the Registration Act is of an *ex officio* nature; the registrar is not appointed by this Department, and consequently there is a feeling among many of them that they cannot be held responsible for work which is outside of their regular duties.

Taking all these matters in consideration is it any wonder we find that so many Division Registrars are quite satisfied with the returns that come to them in the ordinary course of events, and think they have done their full duty when they record these returns and send their schedules to this department once every six months. The Registrar General may not be satisfied with the *extent* of the returns made, but what is he to do? The Division Registrar states he has used "all available means to obtain the necessary information," as called upon to do by the Act. He cannot be expected to go to any great expense in obtaining such information and his statement that he "has used all available means" must be accepted. He is a *municipal clerk*, not a *government official*. Were he the latter, while the returns might yet be far from complete, they certainly would not display the great discrepancies shown in the table of comparisons attached to this report.

I have the honor to be, Sir,

Your obedient servant,

R. B. HAMILTON,

Inspector.

TABLE 1.
Table showing the total number of Births, Marriages and Deaths in each County in 1898.

Counties.	Population.			Births.			Marriages.			Deaths.			Totals.			Ratio to 1,000 of the population.		
	Number in 1898.	Variation from 1897.		Number in 1898.	Variation from 1897.		Number in 1898.	Variation from 1897.		Number in 1898.	Variation from 1897.		Number in 1898.	Variation from 1897.				
		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.			
Algoma.....	17,810	87	.....	89	.....	31	195	.....	31	250	.....	31	1,262	.....	151	45.8	10.9	14.0
Brant.....	39,109	702	.....	.....	29	.....	261	.....	31	440	.....	31	1,403	.....	71	17.9	6.6	11.2
Bruce.....	69,328	1,310	.....	157	9	.....	370	.....	9	601	.....	67	2,281	.....	233	18.8	5.3	8.6
Carleton.....	83,298	2,183	95	.....	1	.....	661	.....	1	1,650	.....	26	4,494	.....	70	26.2	7.6	19.8
Dufferin.....	23,868	449	.....	1	24	.....	152	.....	.....	230	.....	31	831	.....	54	18.8	6.3	9.6
Elgin.....	46,547	763	.....	38	36	.....	268	.....	36	477	.....	31	1,508	.....	105	16.4	4.0	10.2
Fscx.....	59,607	1,607	42	.....	147	.....	1,117	.....	.....	737	.....	19	3,461	.....	170	26.9	18.7	12.3
Frontenac.....	50,447	919	2	.....	53	.....	290	.....	53	705	.....	13	1,914	.....	38	18.2	5.7	13.9
Grey.....	76,423	1,426	.....	55	.....	.....	405	.....	.....	754	.....	35	2,585	.....	20	18.6	5.3	9.8
Haldimand.....	25,152	403	.....	12	.....	15	148	.....	15	248	.....	15	799	.....	42	16.0	5.8	9.8
Halton.....	23,580	410	.....	10	.....	21	84	.....	21	223	.....	8	717	.....	23	17.3	3.5	9.4
Haliburton.....	6,809	222	.....	8	1	.....	33	.....	.....	65	.....	11	320	.....	18	32.6	4.8	9.5
Hastings.....	63,503	1,202	.....	24	21	.....	448	.....	21	689	.....	28	2,339	.....	31	18.9	7.0	10.8
Huron.....	71,661	1,278	3	.....	.....	63	380	.....	63	658	.....	89	2,316	.....	149	17.8	5.3	9.2
Kent.....	62,991	1,313	.....	89	.....	12	422	.....	12	731	.....	2	2,466	.....	99	20.8	6.7	11.6
Lambton.....	58,911	1,170	.....	61	.....	23	398	.....	23	575	.....	58	1,480	.....	143	18.3	6.7	9.7
Lanark.....	40,482	743	.....	9	61	.....	272	.....	61	465	.....	10	2,143	.....	32	18.3	6.7	11.4
Leeds and Grenville.....	65,359	1,062	.....	60	.....	59	402	.....	59	823	.....	10	2,287	.....	109	16.2	6.1	12.6
Lennox and Addington.....	26,557	467	14	.....	17	.....	183	.....	.....	302	.....	29	952	.....	2	17.5	6.8	11.3
Lincoln.....	32,278	560	.....	56	.....	38	164	.....	38	405	.....	57	1,129	.....	151	17.3	5.3	12.5
Middlesex.....	109,417	1,615	50	.....	.....	89	615	.....	89	1,099	.....	63	3,329	.....	102	17.3	6.1	11.0
Muskoka.....	17,782	601	1	.....	.....	29	108	.....	29	196	.....	5	905	.....	33	33.7	5.5	11.0
Nipissing.....	12,636	897	.....	69	.....	6	167	.....	6	269	.....	35	1,323	.....	110	70.9	13.2	20.5
North York.....	33,256	651	.....	17	.....	33	204	.....	33	348	.....	62	1,193	.....	102	19.2	6.1	10.4
Northumberland and Durham.....	75,615	1,218	.....	46	.....	21	419	.....	21	877	.....	9	2,514	.....	58	16.1	5.5	11.6
Ontario.....	48,671	854	.....	49	22	.....	257	.....	22	503	.....	6	1,614	.....	33	17.5	5.2	10.3
Oxford.....	53,493	1,073	36	.....	.....	10	332	.....	10	615	.....	10	2,202	.....	16	20.0	6.2	11.5

Parry Sound	15,791	680	51	121	35	215	16	1,016	102	43.0	7.6	13.6
Peel	26,687	408	14	116	27	245	.....	769	8	15.3	4.3	9.2
Perth	55,498	999	11	374	67	601	.....	1,974	133	18.0	6.7	10.8
Peterborough	37,889	831	59	262	32	481	.....	1,574	3	21.9	6.9	12.7
Prescott and Russell	45,566	1,623	52	353	60	623	.....	2,599	.....	35.6	7.7	13.6
Prince Edward	20,265	305	13	123	5	224	.....	652	27	15.0	6.0	11.0
Rainy River	4,508	235	36	102	40	119	.....	456	47	52.1	22.6	26.1
Renfrew	49,370	1,357	169	342	13	490	.....	2,189	.....	27.4	6.9	9.9
Simcoe	76,974	1,744	27	544	11	847	.....	3,160	.....	22.8	7.0	11.3
Stamont, Dundas and Glengarry ..	74,836	1,338	72	435	20	872	.....	2,630	.....	17.8	5.8	11.3
Thunder Bay	5,836	254	38	73	.....	96	.....	423	6	43.5	12.5	16.4
Victoria	36,401	729	37	224	1	385	.....	1,338	21	20.5	6.3	10.8
Waterloo	54,169	1,151	44	309	35	554	.....	2,014	41	21.2	5.7	10.2
Welland	32,869	656	4	258	20	425	.....	1,939	.....	19.9	7.8	12.9
Wellington	63,782	1,197	52	359	18	593	.....	2,149	1	18.7	5.6	9.3
Wentworth	84,617	1,678	131	565	17	1,104	.....	3,348	255	19.8	6.7	13.0
York	301,250	5,509	40	2,059	241	3,371	.....	11,139	99	18.2	6.8	11.8
Totals	2,279,929	46,599	634	15,375	713	26,370	1,575	88,344	845	20.4	6.7	11.5

TABLE 2.

Table showing the total number of Births, Marriages and Deaths in each City in 1898.

Cities.	Population.	Births.			Marriages.			Deaths.			Totals.			Ratio to 1000 of Population.		
		Number in 1898.	Increase.	Variation from 1897.	Number in 1898.	Increase.	Variation from 1897.	Number in 1898.	Increase.	Variation from 1897.	Number in 1898.	Increase.	Variation from 1897.	Births.	Marriages.	Deaths.
Toronto.....	199,917	4,122	44	.....	1,696	195	.....	2,866	.....	256	8,684	.....	17	20.6	8.4	14.3
Hamilton.....	52,562	1,102	133	.....	434	22	.....	749	73	.....	2,283	228	.....	20.9	8.2	14.2
Ottawa.....	47,332	1,349	76	.....	698	119	.....	1,221	.....	21	3,168	174	.....	28.4	12.6	25.7
London.....	33,273	627	75	.....	289	.....	30	474	15	.....	1,390	60	.....	18.8	8.6	14.2
Kingston.....	20,608	354	.....	2	155	.....	40	323	.....	6	862	.....	48	17.1	7.5	17.1
Brantford.....	13,682	387	.....	21	152	15	.....	219	.....	29	738	.....	35	28.2	11.1	16.0
St. Thomas.....	11,120	158	.....	63	91	.....	7	117	.....	40	369	.....	110	11.2	8.4	10.5
Guelph.....	11,303	246	.....	13	75	.....	23	159	25	.....	489	.....	11	21.6	6.6	14.0
St. Catharines.....	9,837	158	.....	42	66	.....	22	167	7	.....	391	.....	57	16.0	6.7	16.9
Belleville.....	10,639	169	18	.....	109	6	.....	149	.....	38	427	.....	14	15.9	10.2	14.0
Stratford.....	10,191	159	25	.....	84	39	.....	120	17	.....	363	81	.....	15.6	8.2	11.8
Windsor.....	11,074	229	.....	8	705	90	.....	158	.....	11	1,092	71	.....	20.6	63.6	14.2
Chatham.....	9,712	151	.....	48	132	17	.....	142	.....	19	425	.....	50	15.5	13.6	14.6
Total.....	411,360	9,111	371	197	4,589	503	122	6,894	137	420	20,694	614	342	20.6	10.3	15.6

TABLE 3.
Table showing the total number of Births, Marriages and Deaths in each Town in 1898.

Towns.	Population.			Births.			Marriages.			Deaths.			Totals.			Ratio to 1000 of Population.				
	Number in 1898.	Variation from 1897.		Number in 1898.	Variation from 1897.		Number in 1898.	Variation from 1897.		Number in 1898.	Variation from 1897.		Increase.	Decrease.	Number in 1898.	Increase.	Decrease.	Births.	Marriages.	Deaths.
		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.								
Barrie	92	.....	43	57	.....	3	80	.....	4	229	.....	50	14.9	.....	9.2	12.9	12.9
Brockville	180	.....	22	77	.....	8	160	29	.....	417	.....	1	19.0	.....	8.1	16.9	16.9
Burlington	206	.....	6	72	.....	36	113	.....	.....	391	.....	40	25.8	.....	9.0	14.2	14.2
Bracebridge	69	.....	12	16	.....	14	23	10	.....	118	.....	16	43.8	.....	16.5	14.6	14.6
Brampton	42	.....	1	26	.....	11	41	.....	.....	169	.....	28	11.6	.....	7.2	11.3	11.3
Cornwall	187	11	.....	80	20	.....	118	.....	7	385	24	.....	25.7	.....	10.9	16.1	16.1
Cobourg	85	12	.....	27	.....	13	91	20	.....	203	19	.....	15.8	.....	5.0	16.9	16.9
Cayuga	17	2	.....	7	.....	4	7	.....	6	81	.....	8	18.6	.....	7.6	7.6	7.6
Chatham	63	.....	8	28	.....	12	42	.....	13	125	.....	31	12.4	.....	6.6	9.8	9.8
Lindsay	142	15	.....	85	15	.....	90	12	.....	317	42	.....	21.7	.....	13.0	13.8	13.8
London	22	1	.....	8	1	.....	4	.....	6	34	.....	4	19.7	.....	7.1	3.5	3.5
Milton	29	.....	14	11	.....	.....	18	.....	8	58	.....	17	18.0	.....	6.8	11.2	11.2
Napanee	63	.....	8	73	9	.....	46	.....	6	172	.....	5	16.5	.....	16.5	12.1	12.1
Niagara Falls	115	23	.....	31	5	.....	31	7	.....	233	.....	14	32.1	.....	20.3	12.5	12.5
North Bay	245	13	.....	28	.....	.....	123	30	.....	176	25	.....	46.4	.....	12.6	12.6	12.6
Orangeville	25	.....	10	28	.....	5	29	.....	2	82	.....	17	7.6	.....	8.5	8.8	8.8
Owen Sound	164	.....	42	65	.....	2	65	.....	.....	353	28	.....	20.3	.....	8.2	15.2	15.2
Perry Sound	72	.....	24	117	14	.....	154	1	.....	518	.....	9	23.2	.....	10.4	12.2	12.2
Peterboro	247	.....	24	49	.....	4	65	.....	22	236	.....	66	28.6	.....	9.9	13.3	13.3
Pembroke	141	.....	40	53	17	.....	43	.....	15	169	.....	13	20.9	.....	15.2	12.3	12.3
Perth	73	.....	15	42	.....	.....	73	.....	.....	136	.....	19	11.2	.....	11.5	14.5	14.5
Pictou	41	.....	19	42	.....	.....	45	7	.....	152	2	.....	20.5	.....	9.0	12.3	12.3
Port Arthur	75	5	.....	33	.....	9	45	.....	16	309	23	.....	39.5	.....	18.4	18.9	18.9
Rat Portage	454	139	.....	84	31	.....	86	.....	.....	351	7	.....	20.2	.....	17.2	12.9	12.9
Sarnia	695.8	141	.....	120	11	.....	90	.....	11	206	.....	25	30.8	.....	11.1	11.4	11.4
Sault Ste. Marie	3,860	119	.....	43	.....	17	44	.....	2	135	.....	1	19.2	.....	12.9	13.4	13.4
Simcoe	2,970	57	.....	33	.....	9	40	.....	.....	233	.....	24	10.6	.....	6.2	10.9	10.9
Toronto Junction	5,202	139	.....	43	7	.....	71	2	.....	94	.....	11	11.9	.....	4.9	8.5	8.5
Walkerton	3,400	36	.....	21	.....	.....	37	1	.....	76	11	.....	11.9	.....	4.8	11.0	11.0
Welland	3,970	32	.....	16	.....	3	28	.....	.....	97	.....	15	19.8	.....	7.5	11.3	11.3
Whitby	3,094	47	.....	15	.....	6	35	.....	5	339	24	.....	21.2	.....	10.3	13.4	13.4
Woodstock	9,238	184	.....	70	.....	5	103	.....	8	6,677	205	469	21.2	.....	10.3	13.4	13.4
Total	148,621	3,148	137	1,537	131	172	1,991	132	182	6,677	205	469	21.2	.....	10.3	13.4	13.4		

The Town of L'Orignal included in the above totals has been omitted from Table 12.

TABLE 4.
Illegitimate Births, Twins and Triplets in the Province.

Illegitimate Births.		Ratio to 1,000 births.	Number of pair of twins.	Number of cases of triplets.
No.	Proportion to whole number of births.			
678	One to every 68 births	14.5	306	7

TABLE 5.

Births in the Province in 1898, showing the Proportion of Male to Female Births.

Sex.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Males	1,975	1,863	2,196	2,081	2,008	1,930	2,090	2,157	2,115	1,932	1,725	1,824	23,896
Females.....	1,853	1,819	2,120	1,962	1,958	1,834	1,936	2,122	2,030	1,741	1,591	1,737	22,703
Total	3,828	3,682	4,316	4,043	3,966	3,764	4,026	4,279	4,145	3,673	3,316	3,561	46,599
Male births to 100 female births.....	106.5	102.4	103.6	106.0	102.6	105.2	107.9	101.6	104.1	110.9	108.4	105.0	105.2

TABLE 6.
Order of Births by Months in the Province.

Months.	Males.	Months.	Females.	Months.	Total males and females.
March	2,196	August.....	2,122	March	4,316
August	2,157	March	2,120	August	4,279
September	2,115	September	2,030	September	4,145
July	2,090	April	1,962	April	4,043
April	2,081	May	1,958	July	4,026
May	2,008	July	1,936	May	3,966
January.....	1,975	January	1,853	January	3,828
October	1,932	June.....	1,834	June	3,764
June	1,930	February.....	1,819	February	3,682
February	1,863	October	1,741	October	3,673
December	1,824	December	1,737	December	3,561
November.....	1,725	November	1,591	November	3,316
Total	23,896	Total	22,703	Total	46,599

TABLE 7.
Marriages by Months in the Province,

Months.	1897.	Months.	1898.	Quarters.	1897.	Quarters.	1898.
December	1,896	June	1,741	Quarter ending Dec. 31...	4,733	Quarter ending Dec. 31...	4,455
June	1,682	December	1,532	Quarter ending June 30...	3,577	Quarter ending June 30...	3,835
September.	1,633	October	1,488	Quarter ending Sept. 30...	3,522	Quarter ending Sept. 30...	3,550
November	1,453	September	1,463	Quarter ending Mar. 31...	3,437	Quarter ending Mar. 31...	3,531
October	1,384	November	1,435	Date not given.....	24	Date not given.....	
March	1,227	March	1,204				
January	1,147	April	1,197				
February	1,063	January	1,173				
April	989	February	1,154				
July	968	August	1,145				
August	921	July	922				
May	906	May	897				
No date given ..	24	No date given ..	4				
Total	15,293	Total	15,375	Total	15,293	Total	15,378

TABLE 8.
Marriages by Denominations in the Province.

Denominations.	Number of persons married.	Per cent. of whole.	Proportion to the whole number of persons married.
Methodists	10,382	33.8	2.9
Presbyterians	6,400	20.8	4.8
Church of England	4,902	16.0	6.2
Roman Catholics	4,657	15.1	6.6
Baptists	1,908	6.2	16.1
Lutherans	723	2.3	42.5
Congregationalists	271	.9	113.4
Evangelical Association	157	.5	195.8
Mennonites	127	.4	242.1
Quakers	32	.1	960.9
Other denominations	853	2.8	36.0
No denominations given	338	1.1	91.0
Total	30,750	100.0	

TABLE 9.

Showing the Death rate per 1,000 of Population in each County of the Province for ten years.

Counties.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	Average rate for ten years.
Algoma									15.9	14.0	.....
Brant	12.7	12.3	10.5	11.4	11.3	10.4	12.1	12.3	12.2	11.2	11.6
Bruce	7.4	7.1	8.3	8.3	8.3	8.7	7.9	9.7	9.7	8.6	8.4
Carleton	18.2	18.4	8.9	13.6	15.5	16.9	17.7	17.9	20.3	19.8	16.7
Dufferin	9.7	10.0	10.8	9.6	8.9	7.3	7.9	8.0	8.4	9.6	9.0
Elgin	9.2	9.9	9.2	9.1	9.9	8.5	10.2	10.1	11.0	10.2	9.7
Essex	12.1	12.5	12.0	12.2	11.9	11.6	12.0	12.6	12.9	12.3	12.2
Frontenac	15.9	15.7	13.7	14.5	12.4	11.1	11.2	13.3	13.8	13.9	13.5
Grey	7.0	7.3	7.4	7.7	7.7	7.8	8.1	9.7	9.5	9.8	8.2
Haldimand	8.5	6.7	8.2	10.3	6.6	9.5	8.4	7.7	10.5	9.8	8.6
Halton	8.6	8.9	9.3	9.9	9.0	8.7	8.9	9.2	9.2	9.4	9.1
Haliburton			8.0	9.2	8.6	8.2	10.7	12.4	11.2	9.5	9.7
Hastings	10.7	10.6	8.3	8.9	9.0	7.9	9.2	11.2	11.4	10.8	9.8
Huron	7.3	7.4	8.2	8.5	9.1	7.4	7.7	8.3	10.5	9.2	8.3
Kent	8.6	8.3	8.4	8.7	8.7	9.3	9.2	9.8	11.7	11.6	9.4
Lambton	9.5	9.1	8.1	8.4	9.1	8.0	7.6	8.6	10.8	9.7	8.8
Lanark	8.4	8.9	6.6	7.4	7.6	8.9	6.9	10.2	11.8	11.4	8.8
Leeds and Grenville	8.2	8.8	7.1	7.2	8.2	6.5	7.3	10.9	12.5	12.6	8.9
Lennox and Addington	9.4	7.3	10.1	7.7	7.0	10.2	6.8	9.4	12.6	11.3	8.9
Lincoln	11.4	12.8	10.9	14.3	11.4	13.0	13.1	12.2	14.4	12.5	12.6
Middlesex	10.4	11.6	8.9	10.9	10.1	10.0	9.6	8.7	10.7	10.0	10.1
Muskoka									11.4	11.0	.....
Norfolk	7.3	8.1	8.5	9.5	8.2	8.1	9.2	9.4	12.1	10.4	9.0
Northumberland and Durham	8.1	9.9	10.7	10.1	9.7	10.5	9.9	10.1	11.6	11.6	10.2
Nipissing									23.5	20.5	.....
Ontario	9.3	9.4	9.8	11.0	10.3	10.0	9.8	10.2	10.6	10.3	10.0
Oxford	10.9	11.1	9.7	11.4	10.9	10.9	10.3	11.3	11.8	11.5	10.9
Peel	9.2	7.8	7.7	7.5	7.9	7.8	7.1	9.4	9.1	9.2	8.2
Perth	8.3	8.2	8.9	9.1	8.1	8.9	9.0	8.8	9.5	10.8	8.9
Peterborough	10.6	11.4	11.1	12.1	10.8	12.6	10.4	11.2	12.0	12.7	11.4
Prescott and Russell	14.3	14.3	10.6	12.9	11.7	14.9	11.7	13.1	16.9	13.6	13.4
Prince Edward	10.1	11.3	11.1	11.5	11.6	12.8	9.7	13.8	12.4	11.0	11.5
Parry Sound									14.7	13.6	.....
Rainy River									33.1	26.1	.....
Renfrew	8.8	7.2	7.7	9.5	9.6	10.6	9.9	12.2	13.0	9.9	9.8
Simcoe	8.0	6.4	8.1	8.1	8.2	9.3	7.4	10.7	11.7	11.3	8.9
Stormont, Dundas and Glengarry	8.8	9.2	8.5	8.9	8.8	7.3	7.8	9.0	12.7	11.3	9.2
Thunder Bay									20.4	16.4	.....
Victoria	9.1	7.7	9.9	10.9	10.0	9.7	9.0	9.8	10.8	10.8	9.7
Waterloo	11.1	11.9	11.6	10.5	9.9	9.9	10.1	10.1	10.9	10.2	10.6
Welland	11.1	9.4	12.4	10.5	11.1	9.5	11.0	12.1	14.4	12.9	11.4
Wellington	10.0	9.2	10.1	10.6	9.8	10.3	9.5	9.5	9.9	9.3	9.8
Wentworth	15.1	14.4	13.2	11.7	13.1	12.5	12.7	13.2	12.1	13.0	13.1
York	19.0	16.3	15.9	16.4	16.1	13.1	13.2	12.4	12.9	11.8	14.7
Average rate	10.7	11.1	10.2	10.7	10.6	10.3	10.1	10.9	12.2	11.5	10.8

Owing to the changing of territorial boundaries in Algoma, Nipissing, Muskoka and Parry Sound, they have been inserted in this table for 1897 and 1898 only.

TABLE No. 11.

36

TABLE No. 12.
Recapitulation by Classes of Diseases by Towns, 1898.

Cause of Death.	Sex.		Nativity.		Social condition.		Age.										Months.												Totals.												
	Male.	Female.	Not stated.	Canada.	Foreign.	Not stated.	Single.	Married.	Not stated.	Under 5.					5-9.					January.	February.	March.	April.	May.	June.	July.	August.	September.		October.	November.	December.									
										0-1.	1-2.	3-4.	5-9.	10-14.	15-19.	20-24.	25-29.	30-34.	35-39.														40-44.	45-49.	50-59.	60-69.	70-79.	80 and over.			
I. Communicable (Epidemic) diseases	70	64	...	111	12	11	97	18	19	14	7	11	9	9	19	5	8	8	9	5	3	3	7	1	3	2	13	12	11	7	8	5	9	12	14	16	9	18	134		
II. Other general diseases	194	229	...	294	111	18	156	118	149	29	5	6	3	3	10	9	28	49	40	31	28	25	29	46	51	19	8	30	26	45	44	42	41	36	35	44	27	26	27	423	
III. Diseases of nervous system and organs of sense	124	110	...	159	65	10	105	66	63	49	12	9	1	2	14	7	3	3	5	3	6	1	6	16	37	38	19	3	22	21	16	23	26	20	17	23	19	13	15	19	234
IV. Diseases of circulatory system	83	73	...	86	64	6	22	65	69	...	1	1	1	3	1	6	4	8	4	10	7	11	25	43	24	8	13	16	15	15	20	14	8	14	11	6	10	14	156		
V. Diseases of the respiratory system	90	82	...	110	59	3	74	53	45	41	10	5	2	3	3	2	5	4	4	6	4	5	15	22	24	16	1	16	21	18	20	18	11	7	3	1	12	13	32	172	
VI. Diseases of the digestive system	93	121	...	177	33	4	143	29	42	96	20	4	1	3	9	2	7	8	4	6	7	11	20	4	5	...	15	6	11	3	15	11	26	59	34	13	13	8	214		
VII. Diseases of the genito-urinary system	44	28	...	33	38	1	7	25	40	2	...	1	1	2	1	2	4	3	5	...	3	13	17	14	4	1	6	5	5	5	10	8	8	5	6	3	1	10	72		
VIII. Puerperal diseases	13	...	11	2	11	2	2	...	2	2	3	3	1	3	...	1	1	1	1	1	2	1	13	
IX. Diseases of the skin and cellular tissue	2	1	...	1	2	...	1	...	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	3
X. Diseases of the locomotor system	3	...	...	3	...	...	2	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	2	...	...	...	...	...	...	...	...	...	...	3
XI. Malformations, diseases of infancy, diseases of old age	218	196	1	263	144	3	234	87	94	229	1	67	117	1	...	25	54	31	40	35	26	24	49	37	34	28	32	415	
XII. Suicide	4	3	...	6	1	...	2	2	3	7	
XIII. Accident	72	17	...	50	27	12	37	16	36	3	4	3	6	3	5	11	5	6	5	5	10	9	8	1	...	5	4	7	2	8	17	9	11	8	6	4	8	8	89		
XIV. Ill-defined causes	26	26	...	32	15	5	10	20	22	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	8	6	6	4	1	4	4	4	8	3	3	52
Totals	1023	963	1	1341	573	73	890	510	587	462	57	41	15	23	60	36	61	97	70	80	54	75	150	214	181	14	149	179	166	168	188	155	148	216	181	141	124	172	1987		

TABLE

TOTAL DEATHS BY INDIVIDUAL

	Algoma.	Brant.	Bruce.	Carleton.	Dufferin.	Elgin.	Essex.	Frontenac.	Grey.	Haldimand.	Halton.	Haliburton.	Hastings.	Huron.	Kent.	Lambton.	Lanark.	Leeds & Grenville.	Lennox & Addington.	Lincoln.		
Communicable Diseases.	Typhoid fever.....	1	12	13	25	3	5	8	24	11	6	6	..	12	9	11	13	2	12	5	8	
	Smallpox.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Measles.....	..	..	1	27	..	2	..	5	1	..	2	..	4	2	..	..	5	6	..	..
	Scarlet fever.....	1	4	3	4	..	7	3	6	2	1	..	1	3	7	12	21	9	6	1	1	
	Whooping cough.....	1	2	..	11	..	2	5	6	8	..	1	1	2	4	4	1	..	7	1	1	
	Diphtheria and croup....	4	3	13	39	17	15	38	12	11	9	6	3	26	7	36	21	11	15	6	4	
	Influenza.....	6	4	2	9	1	6	11	1	10	2	1	..	6	3	6	2	1	2	4	1	
	Other epidemic diseases..	..	..	1	1	..	..	1	..	..	..	..	..	..	..	..	3	..	..	..	..
	Pyaemia and septicaemia	6	5	6	20	4	10	8	10	24	4	4	1	10	11	7	11	11	19	4	7	
	Malarial fever.....	..	..	..	..	..	..	..	..	..	..	..	..	1	1	1	..	..	..	..	..
Other General Diseases.	Tuberculosis and scrofula	27	41	82	204	28	58	75	92	90	25	24	7	78	77	88	62	61	132	38	47	
	Syphilis.....	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Cancer.....	1	11	26	42	10	13	18	30	27	12	15	1	14	31	32	19	10	34	9	16	
	Rheumatism and gout....	..	2	1	1	1	4	1	5	4	1	..	..	2	5	4	..	3	8	4	6
	Diabetes.....	1	2	4	9	3	4	5	4	5	2	..	..	4	5	2	7	4	6	3	2
	Other general diseases....	2	1	7	6	1	..	2	5	2	3	..	..	2	1	2	2	4	2	2	..
	Alcoholism, acute & ch'ic.	..	..	..	..	..	..	2	1	..	..	..	..	1	1	..	1	..	..	..	..
	Encephalitis.....	2	4	1	6	1	9	2	9	9	..	..	1	8	3	4	4	4	8	4	2
	Simple meningitis.....	..	7	3	25	2	2	9	3	8	..	1	1	6	6	10	6	2	6	4	4	
	Epidemic cerebro-spinal meningitis.....	3	3	5	12	1	2	10	8	7	3	3	1	6	..	2	4	3	5	..	2	
Diseases of the Nervous System.	Congestion and hemorrhage of the brain.....	1	12	19	30	8	8	18	15	11	10	11	3	12	31	24	13	9	27	11	6	
	Softening of the brain....	..	1	1	2	..	1	..	..	..	..	1	1	1	2	3	1	..	3	1	..
	Paralysis without specified cause.....	5	9	21	48	9	26	18	32	28	14	12	2	32	18	24	16	24	26	18	12	
	Insanity.....	1	..	2	..	..	2	2	3	1	..	..	..	1	1	1	..	..	9	..	1
	Epilepsy.....	3	1	1	5	..	..	3	2	1	..	..	..	1	3	2	3	..	3	..	2
	Convulsions (n't puerperal)	8	7	12	85	5	11	8	18	11	3	4	3	11	16	11	19	5	12	4	8	
	Other nervous diseases....	..	1	5	6	1	3	..	2	1	..	..	..	2	4	1	1	..	2	1	..
	Pericarditis.....	..	..	..	2	..	..	..	1	..	..	..	..	..	2	..	..	..	..	..	2
	Endocarditis.....	..	2	3	1	1	1	3	1	..	..	..	..	..	..	..	3	..	..	1	..
	Organic Heart Diseases..	13	23	28	69	13	16	35	27	43	15	14	..	32	35	38	26	13	47	12	30	
Diseases of Circulation.	Angina Pectoris.....	1	2	1	2	..	..	1	1	..	..	..	2	2	4	2	2	2	..	1	..
	Diseases of the Arteries.	..	..	1	1	..	1	1	2	1	..	..	..	1	..	..	..	1	1	..	..
	Atheroma, Aneurism, et c.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Other Diseases of the Circulatory System.....	4	2	7	13	6	17	10	14	15	5	5	1	10	9	10	12	12	19	8	11	
	Acute Bronchitis.....	6	5	2	45	1	1	7	8	12	1	2	1	4	8	7	8	3	7	3	9	
	Chronic Bronchitis.....	2	2	6	9	3	3	4	5	5	3	1	..	4	8	3	..	3	5	..	9	
	Broncho-pneumonia.....	1	..	2	21	2	1	4	..	2	..	2	..	9	4	1	4	..	8	1	7	
	Pneumonia.....	14	45	28	79	10	32	47	48	32	10	15	2	62	37	36	29	31	35	15	32	
	Pleurisy.....	2	..	1	1	2	2	4	2	3	..	..	..	1	1	3	2	3	4	..	1
	Cong't'n of the Lungs (including pulmonary apop)	5	7	9	18	2	7	2	1	8	..	1	..	4	5	3	4	4	7	5	5	
Diseases of Respiration.	Asthma and Emphysema	2	3	1	5	3	2	4	2	2	..	..	2	3	3	2	2	2	4	2	..
	Other Diseases of the Respiratory System.....	1	..	..	1	..	..	..	..	2	..	1	2	..	1	..	..	..	..	1	..
	Ulcer of the Stomach.....	..	..	..	1	..	..	..	1	2	1	..	..	..	..	..	..	2	1	1	1
	Other Diseases of the Stomach (Cancer excepted)	..	4	3	5	2	2	4	6	11	5	1	..	5	5	9	6	5	10	3	5	
	Infantile Diarrhoea and Gastro-enteritis, (Cholera Infantum).....	12	15	17	188	3	24	55	19	30	10	8	4	27	23	57	15	17	43	10	15	
	Diarrhoea and Enteritis (not infantile).....	3	9	9	9	3	6	13	7	17	3	2	1	11	9	8	7	12	21	4	9	
	Dysentery.....	..	1	1	6	1	1	3	1	1	2	1	..	4	5	4	2	8	5	2	..	
	Hemorrhoids and Intestinal obstructions.....	1	3	3	3	3	2	2	6	5	1	3	3	6	2	1	3	2	4	
	Diseases of Digestion.
	
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No. 13.

DISEASES BY COUNTIES IN 1898.

Middlesex.	Muskoka.	Norfolk.	North'm'd & Durh'm.	Nipissing.	Ontario.	Oxford.	Peel.	Perth.	Peterborough.	Prescott & Russell.	Prince Edward.	Parry Sound.	Rainy River.	Renfrew.	Simcoe.	Stormont, D. & G.	Thunder Bay.	Victoria.	Waterloo.	Welland.	Wellington.	Wentworth.	York.	Totals.
22	3	6	13	4	7	13	2	6	11	5	3	2	17	9	8	10	..	11	12	6	2	10	39	405
2	1	..	..	2	2	..	..	2	4	1	..	..	1	4	4	8	..	7	3	..	3	..	9	115
24	..	2	5	1	4	8	2	15	1	1	1	1	2	3	2	4	..	..	6	2	4	12	30	222
2	..	1	3	4	5	4	..	3	2	3	2	2	1	1	3	6	4	1	4	6	3	1	8	126
23	6	4	9	15	5	8	2	11	6	31	7	14	2	17	11	13	4	7	21	3	5	31	84	634
5	2	4	6	3	15	5	2	3	3	6	..	2	1	3	6	4	1	4	6	3	6	3	22	192
2	..	..	..	..	..	..	..	1	1	2	..	2	..	..	..	1	1	..	..	..	..	..	15	15
23	2	7	18	3	4	12	6	14	6	8	2	5	5	11	25	17	1	4	13	10	20	20	64	482
4	..	1	1	1	1	1	2	..	3	..	..	..	..	..	1	1	1	1	1	1	..	..	4	25
135	19	36	97	23	67	72	35	96	69	59	24	32	15	48	105	116	7	50	53	36	67	140	554	3,291
..	..	1	1	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	8	14
51	6	16	37	3	17	15	19	32	18	7	13	3	1	12	27	28	1	9	29	23	38	43	156	975
2	..	4	6	..	7	7	1	1	6	4	1	..	2	1	2	5	1	3	6	1	4	9	15	140
7	..	5	2	1	3	2	2	6	4	2	2	2	2	2	7	6	..	3	4	2	1	5	17	157
4	..	2	1	1	4	1	3	4	1	..	1	1	2	2	6	5	..	1	1	3	2	6	19	112
1	..	1	1	..	..	..	..	2	2	..	..	..	..	..	2	..	1	..	..	..	..	1	2	17
5	2	5	5	3	1	2	1	4	2	13	2	..	1	6	6	5	1	5	3	6	4	8	27	198
12	2	..	7	..	3	3	..	8	2	6	6	2	..	2	1	2	2	1	2	1	1	4	42	214
2	1	2	3	1	5	5	1	5	2	5	1	1	..	3	3	4	1	5	1	6	2	14	37	190
39	3	12	24	1	23	22	8	25	18	6	2	9	2	6	24	13	3	5	31	17	20	48	131	771
3	..	1	5	..	1	2	..	2	..	..	3	..	..	..	3	1	..	..	3	..	..	6	17	65
42	3	17	38	1	5	31	6	14	10	14	7	1	1	6	26	26	1	8	7	33	24	33	78	825
6	..	..	..	..	1	1	1	1	1	..	1	1	1	1	2	1	..	..	..	..	..	14	18	71
5	..	2	4	..	..	..	..	1	3	2	1	1	..	7	9	3	..	3	..	2	4	3	21	101
25	5	12	20	12	13	15	6	14	16	12	1	13	3	11	18	17	7	12	17	19	20	21	116	686
2	1	..	5	..	3	3	..	1	1	1	..	1	..	1	1	5	..	2	1	1	3	4	10	76
1	..	2	..	1	1	3	..	..	1	..	..	1	..	..	2	..	..	1	1	..	..	2	1	23
3	..	2	3	..	1	1	1	5	1	..	..	2	..	1	4	3	..	2	2	3	3	3	17	69
58	13	15	33	8	34	31	10	27	21	17	10	11	3	14	37	32	5	18	26	20	34	60	194	1,260
1	1	3	3	..	2	2	1	..	..	..	..	..	..	1	1	..	..	..	3	..	..	3	2	46
1	1	..	1	..	1	..	..	1	1	1	..	1	..	..	..	2	..	..	..	2	1	..	6	29
24	1	10	20	1	7	5	12	14	8	5	6	5	3	6	14	16	1	7	7	12	13	8	30	423
10	11	6	12	8	7	1	2	9	9	1	1	1	2	11	29	8	5	7	15	10	8	22	55	398
9	1	3	9	..	2	3	..	1	1	1	4	..	..	3	5	4	..	2	6	3	4	8	24	168
2	10	3	8	1	4	6	..	4	6	..	..	..	2	1	7	2	2	1	6	3	5	20	49	208
51	9	23	66	16	26	52	17	33	20	33	14	3	10	24	59	61	7	16	25	19	37	85	167	1,512
3	..	1	3	1	..	1	1	3	..	..	1	1	1	..	3	3	1	1	3	..	4	2	5	70
10	1	1	15	2	5	5	2	4	2	6	..	2	1	5	3	11	1	5	6	7	5	7	20	223
3	..	3	4	..	3	1	..	7	2	3	1	1	..	1	3	5	..	1	3	1	..	6	17	109
1	1	1	..	1	1	3	1	..	1	1	..	..	..	..	..	1	..	..	..	1	1	4	..	27
1	..	1	1	..	..	..	..	..	1	1	..	..	..	1	2	..	..	..	..	1	..	1	4	23
10	2	1	5	1	9	5	2	2	5	3	2	2	..	2	6	3	3	4	1	6	3	5	22	195
37	4	14	19	16	24	15	4	19	15	58	7	12	8	42	41	47	4	18	24	17	22	40	226	1,325
17	5	7	16	6	6	9	2	8	9	13	4	1	1	8	19	10	..	6	4	7	4	7	15	347
5	..	2	3	..	3	..	1	4	1	..	1	..	..	1	5	6	..	6	2	1	..	2	10	101
8	2	6	6	..	2	4	1	3	3	..	1	1	..	..	5	6	..	3	8	..	7	3	10	131

—Concluded.

DISEASES BY COUNTIES IN 1893.

Middlesex.	Muskoka.	Norfolk.	Northum'd & Durh'm.	Nipissing.	Ontario.	Oxford.	Peel.	Perth.	Peterborough.	Prescott & Russell.	Prince Edward.	Parry Sound.	Rainy River.	Renfrew.	Simcoe.	Stormont, D. & G.	Thunder Bay.	Victoria.	Waterloo.	Welland.	Wellington.	Wentworth.	York.	Totals.	
15 8	4 1	9 2	16 5	1 .	8 6	8 5	2 2	2 4	2 2	1 2	7 4	2 1	2 .	5 3	10 8	6 2	6 5	6 5	8 4	8 5	9 9	10 12	32 59	1 .	29 285 234
5 1 19	1 1 1	1 2 6	1 3 20	2 3	2 5	7 9	2 1	2 1	3 12	3 10	1 2	1 4	2 2	1 5	5 23	6 19	1 4	2 6	5 16	2 14	9 9	7 35	19 86	150 80 520	
...	...	2	1	...	1	1	1	2	1	3	2	3	7	
5 1	1 1	2 5	6	4	1	3	3	1	3	1	...	2	6	4	...	2	...	1	4	6	11 25	42 150	
2 1 1	...	1	1	...	1	1	1	1	7 12 5	
3	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	1	4	12
...	1	...	2	2	1	2	...	1	...	4	...	1	1	2	1	1	1	2	2	2	5	5 58	
2	2	2	1	...	4	2	...	...	1	2	1	1	...	...	2	1	...	...	1	...	4	13	53
5	2	...	1	4	3	5	2	2	3	2	...	2	...	11	1	7	...	3	4	5	2	10	134		
1	1	3	1	...	3	2	1	3	2	2	2	4	1	1	3	2	12	66	
1	...	2	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1	1	8
...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1	1	...	3	2	5
1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1	1	...	1	...	14
20	4	4	19	10	19	31	3	12	25	18	1	6	6	15	34	28	5	24	17	7	14	63	210	1 961	
58 1 133	18 2 19	18 1 34	63 10 134	49 10 53	28 39 65	11 3 41	27 3 82	32 15 60	136 60 51	10 33 8	23 1 8	8 .	60 56	46 114	57 94	9 1	29 43	32 62	27 37	51 56	79 86	259 213	1,950 54 2,780		
...	...	...	...	...	...	2	1	...	...	1	...	...	1	1	1	...	...	...	1	1	1	10	6 29 33
2	...	...	1	...	...	2	1	...	...	...	1	...	...	3	...	...	...	2	...	2	1	3	...
...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	11
4	...	1	1	1	...	...	1	1	1	3	...	...	2	3	1	...	...	1	...	1	3	1	12
34	4	6	9	6	7	16	3	7	6	3	7	4	5	6	15	21	6	5	9	8	9	15	34	408	
1	...	...	1	2	1	1	1	1	3	...	...	1	...	...	1	2	1	...	...	2	2	3	3
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7
6	5	2	5	6	5	2	...	2	7	3	6	7	3	11	9	8	1	3	4	5	3	7	13	225	
1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1	3	8
6	3	2	13	2	1	1	3	...	3	1	2	1	2	2	1	9	5	...	...	1	4	3	18
8	...	1	...	1	1	3	...	1	2	...	1	1	3	2	6	1	1	2	2	2	6	15	87		
2	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	14
3	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	1	...	4	18
14	3	3	8	4	4	8	3	4	8	4	4	2	7	11	10	...	7	10	11	5	2	10	280		
16	1	5	10	3	10	2	8	4	6	4	2	3	4	11	7	...	2	6	2	4	8	25	238		
11	4	1	5	17	5	7	2	7	5	18	4	8	2	17	14	8	...	2	3	2	2	7	13	302	
2	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	10
1,099	196	348	877	259	503	615	245	601	481	623	224	215	119	490	872	847	96	385	554	425	593	1,104	3,571	26,370	

TABLE No. 14.

Total Deaths by Individual Diseases in Cities in 1898.

General diseases.	Toronto.	Hamilton.	Ottawa.	London.	Kingston.	Brantford.	St. Thomas.	Guelph.	St. Catharines.	Belleville.	Stratford.	Windsor.	Chatham.	Totals.
I.—COMMUNICABLE (EPIDEMIC) DISEASES.														
Typhoid Fever	32	7	20	12	11	9	1	...	4	2	1	1	4	104
Smallpox	8	...	22	1	...	...	...	3	...	...	1	...	...	35
Measles	28	10	3	9	...	2	...	2	1	2	...	...	...	57
Scarlet Fever	7	1	11	1	2	1	1	...	1	...	...	1	1	27
Whooping Cough	63	22	32	11	3	2	3	...	3	3	3	...	2	147
Diphtheria and Croup	18	1	8	3	1	3	1	...	...	...	...	1	...	36
Influenza	...	...	1	1	...	...	...	...	...	...	...	...	...	2
Other epidemic diseases	...	...	...	...	...	...	...	...	...	...	...	...	...	...
II.—OTHER GENERAL DISEASES.														
Pyæmia and Septicæmia	58	13	14	11	4	2	2	5	5	2	2	1	4	123
Malarial Fever	3	...	...	1	...	...	...	...	1	...	...	...	...	5
Tuberculosis and Scrofula	483	109	148	64	45	23	13	21	21	15	19	23	14	993
Syphilis	7	...	3	...	...	...	1	...	...	...	...	...	...	10
Cancer	129	31	29	16	20	2	1	18	2	4	12	3	7	274
Rheumatism and Gout	12	5	...	...	1	2	3	...	3	1	2	...	2	31
Diabetes	16	4	6	4	2	...	...	...	1	1	1	1	...	36
Other general diseases	12	3	5	2	3	...	...	2	...	...	...	2	1	30
Alcoholism, Acute and Chronic	1	1	...	1	1	...	...	...	...	1	...	...	...	5
LOCAL DISEASES.														
III.—DISEASE OF NERVOUS SYSTEM AND ORGANS OF SENSE.														
Encephalitis	20	5	4	3	3	3	3	...	1	1	2	1	...	46
Simple Meningitis	35	4	21	9	2	7	1	...	1	2	2	2	3	89
Epidemic Cerebro-spinal Meningitis	28	12	9	1	5	2	...	1	1	1	1	3	1	65
Congestion and Hemorrhage of the Brain	106	32	22	24	6	7	1	10	1	4	3	2	2	220
Softening of the Brain	14	4	2	1	...	...	...	...	...	...	1	...	1	23
Paralysis without specific cause	57	13	35	16	18	4	7	2	6	3	1	5	5	172
Insanity	5	...	...	...	1	...	...	...	...	...	...	...	...	6
Epilepsy	17	...	4	3	...	1	...	1	...	...	...	...	1	27
Convulsions (not puerperal)	90	17	78	14	12	2	5	6	3	3	...	5	7	242
Other nervous diseases	6	3	4	...	2	1	...	1	1	...	...	...	...	18
IV.—DISEASES OF CIRCULATORY SYSTEM.														
Pericarditis	1	1	2	1	...	...	...	...	1	...	...	...	...	6
Endocarditis	14	3	1	...	1	2	...	1	...	1	2	...	...	25
Organic Heart Diseases	148	42	49	23	17	11	3	10	15	12	2	16	9	362
Angina Pectoris	2	2	2	...	...	1	...	...	...	2	...	...	2	11
Diseases of the Arteries, Atheroma, Aneurism, etc	5	...	1	...	...	...	...	...	...	1	...	1	...	8
Other diseases of the Circulatory System	22	6	10	7	8	3	4	...	3	...	9	1	1	74
V.—DISEASES OF THE RESPIRATORY SYSTEM.														
Acute Bronchitis	43	17	36	4	6	...	...	4	6	1	2	1	...	120
Chronic Bronchitis	19	7	4	3	4	...	2	1	4	3	...	1	...	48
Broncho-pneumonia	41	16	19	...	...	...	1	4	3	1	...	1	...	86
Pneumonia	132	53	50	25	26	19	11	6	11	13	5	10	7	368
Pleurisy	3	2	1	1	...	...	...	...	...	...	...	...	1	8
Congestion of the Lungs (including pulmonary apoplexy)	17	6	12	5	...	3	2	...	1	2	...	1	...	49
Asthma and Emphysema	14	2	3	...	2	1	...	...	...	...	1	...	...	23
Other diseases of the Respiratory System	...	1	1	...	...	...	...	...	...	...	...	...	2	4
VI.—DISEASES OF THE DIGESTIVE SYSTEM.														
Ulcer of the Stomach	4	...	...	...	...	...	...	...	1	...	...	...	...	5
Other diseases of the stomach (Cancer excepted)	19	3	3	2	3	3	...	...	2	...	1	1	2	39
Infantile Diarrhoea and Gastro-enteritis, ("Cholera Infantum")	182	30	158	17	15	11	6	10	6	8	3	12	10	468
Diarrhoea and Enteritis (not infantile)	13	1	5	6	3	3	...	2	2	...	1	1	...	37
Dysentery	3	1	2	2	...	...	...	...	...	2	...	...	3	13
Hernia and Intestinal obstructions	9	2	2	5	3	1	...	3	1	2	1	...	2	31
Other diseases of the Intestines	1	...	6	...	4	1	...	...	...	...	2	...	...	14
Diseases of the Liver	26	7	10	7	1	4	2	...	...	2	...	...	...	59

TABLE No. 14.—Continued.

General diseases.	Toronto.	Hamilton.	Ottawa.	London.	Kingston.	Brantford.	St. Thomas.	Guelph.	St. Catharines.	Belleville.	Stratford.	Windsor.	Chatham.	Totals.
Peritonitis (not puerperal)	49	9	14	2	5	3	...	3	4	1	...	1	2	93
Iliac abscess (typhlitis, perityphlitis, appendicitis)	16	6	5	3	3	2	1	4	1	3	1	...	...	45
VIII.—DISEASES OF THE GENITO-URINARY SYSTEM.														
Acute Nephritis	22	3	4	...	1	3	...	...	...	1	...	...	...	34
Bright's Disease	70	19	15	9	9	3	1	4	2	7	2	4	2	147
Other diseases of the Kidneys and Adnexa	2	...	1	...	...	...	...	...	...	1	...	...	...	4
Vesical Calculi	9	2	...	...	2	1	...	2	...	...	...	1	...	17
Diseases of the Bladder	19	6	8	1	3	4	...	...	3	...	...	...	2	46
Diseases of the male Genital Organs. Metritis .....	...	...	1	2	...	...	...	...	...	...	...	...	...	3
Other diseases of the Uterus	1	...	1	1	...	...	...	...	...	...	...	...	...	1
Ovarian Cysts and other Ovarian Tumors	3	...	1	2	...	...	...	1	1	...	...	...	...	8
Other diseases of the female Genital Organs .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...
VIII.—PUERPERAL DISEASES.														
Puerperal Septicaemia	2	...	3	1	...	...	...	...	1	...	...	...	1	8
Puerperal Albuminuria and Convulsions	8	4	...	...	...	...	...	...	...	...	...	...	2	14
Other accidents of Pregnancy sudden death	10	2	...	...	...	...	1	...	2	...	1	1	1	18
Puerperal Disease of the Breast .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...
IX.—DISEASES OF THE SKIN AND CELLULAR TISSUE.														
Erysipelas	9	...	3	...	1	...	...	2	...	1	...	...	...	16
Other diseases of the Skin and its Adnexa (Cancer excepted)	1	...	...	1	...	...	...	...	...	...	...	...	...	2
X.—DISEASES OF THE LOCOMOTOR SYSTEM.														
Pott's Disease	2	3	...	...	...	...	...	...	...	...	...	...	...	5
Disease of Bones and Joints .....	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Amputation (for unspecified disease)	1	...	...	...	...	...	...	...	...	...	...	...	...	1
XI.—MALFORMATIONS, DISEASES OF INFANCY, DISEASES OF OLD AGE.														
Still-Births	187	52	86	11	13	13	6	4	9	2	7	18	11	419
Congenital Debility and Malformations	207	52	109	24	13	22	5	13	15	7	8	16	7	493
Other diseases of Infancy .....	...	4	2	1	1	...	...	...	...	1	...	...	...	9
Senile decay	152	48	56	35	50	18	16	8	8	15	18	6	12	442
XII.—SUICIDE.														
Poison	8	1	1	...	...	...	...	...	...	...	...	1	...	11
Strangulation	1	1	...	...	...	...	...	...	...	...	...	...	...	3
Gas Poisoning .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Drowning .....	...	...	...	...	...	...	...	...	...	1	...	...	...	1
Firearms	1	1	1	...	...	...	...	1	...	...	...	...	1	5
XIII.—ACCIDENTS.														
Strangulation	3	...	2	...	...	...	...	...	1	...	...	...	...	6
Fractures and Dislocations	25	13	6	25	6	4	2	1	1	1	4	2	2	92
Gunshot	1	1	...	...	...	...	...	...	...	...	...	...	...	2
Lightning .....	...	...	...	1	...	...	...	...	...	...	...	...	...	1
Drowning	10	4	7	4	4	3	1	2	3	...	...	1	4	43
Electric Cars	3	1	1	1	...	...	...	...	...	...	...	...	...	6
Bicycles .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Railways	3	2	6	4	1	3	3	1	1	5	...	4	1	34
Burns and Scalds	15	5	3	2	...	1	1	...	...	1	...	3	...	31
Homicide	4	...	...	2	...	...	...	...	...	...	...	...	...	6
Gas Poisoning .....	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Poison	3	...	...	3	...	...	...	...	...	...	...	...	...	6
XIV.—ILL-DEFINED CAUSES.														
Dropsy	5	2	6	7	...	1	4	...	1	4	...	...	...	30
Tumors	30	4	8	5	5	1	1	...	...	1	1	...	...	56
Other ill-defined causes	11	4	11	5	1	1	2	...	1	2	3	...	...	41
Lockjaw .....	...	1	1	1	...	...	...	...	1	...	...	...	...	4
Total	2,866	749	1,221	474	353	219	117	159	167	149	120	158	142	6,891

TABLE
Total Deaths by Individual

General Diseases.	Barrie.	Berlin.	Bracebridge.	Brockville.	Brampton.	Cayuga.	Cobourg.	Corwall.	Goderich.	Lindsay.	L'Orignal.	Milton.	Napanee.	Niagara Falls.
I.—COMMUNICABLE (EPIDEMIC) DISEASES.														
1. Typhoid Fever	1	1	1	2	2			3	1	5				1
2. Smallpox														
3. Measles										2				
4. Scarlet Fever				1			2		2					
5. Whooping Cough								8				1		1
6. Diphtheria and Croup		13		5			1	2		1		1	1	1
7. Influenza	1	1		1										
8. Other Epidemic Diseases														
II.—OTHER GENERAL DISEASES.														
1. Pyæmia and Septicæmia	1	1		3	2	1	2	1		1			1	2
2. Malarial Fever	1									1				
3. Tuberculosis and Scrofula	13	10	4	26	10	1	6	17	5	11	1	7	8	3
4. Syphilis														
5. Cancer	1	4		8	1		8	2	2	3		1	1	2
6. Rheumatism and Gout	1	1			2		2							
7. Diabetes		1		1	1		1							
8. Other General Diseases					1		2	2		1				
9. Alcoholism, Acute and Chronic							1							
LOCAL DISEASES.														
III.—DISEASES OF NERVOUS SYSTEM AND ORGANS OF SENSE.														
1. Encephalitis	1	1		1						2			1	
2. Simple Meningitis	1	2		2			2		1					
3. Epidemic Cerebro-spinal Meningitis				1				1		1				1
4. Congestion and Hemorrhage of the Brain	3	7	1	7	2		1	6	2	1		3	3	
5. Softening of the Brain							1							
6. Paralysis without specified cause	1					2	3	1		1		1	4	3
7. Insanity	2													
8. Epilepsy				1				1						
9. Convulsions (not puerperal)		1		1			4	5		2	1			4
10. Other Nervous Diseases				2			1	1	1					
IV.—DISEASES OF CIRCULATORY SYSTEM.														
1. Pericarditis								1						
2. Endocarditis														
3. Organic Heart Diseases	2	2	2	19	3	1	2	4	3	8			1	2
4. Angina Pectoris	1				1		1		1					
5. Diseases of the Arteries, Atheroma, Aneurism, etc														
6. Other Diseases of the Circulatory System	2			1	2		2	1		1			2	1
V.—DISEASES OF THE RESPIRATORY SYSTEM.														
1. Acute Bronchitis	3	3	1	3				2		2				2
2. Chronic Bronchitis	1	1		1			1		1					1
3. Broncho-pneumonia				4	3			1					1	1
4. Pneumonia	9	3	3	10		1	8	3	3	6		1	2	1
5. Pleurisy														
6. Congestion of the Lungs (including pulmonary apoplexy)		1					1	1					2	1
7. Asthma and Emphysema							1							
8. Other Diseases of the Respiratory System					1									
VI.—DISEASES OF THE DIGESTIVE SYSTEM.														
1. Ulcer of the Stomach														
2. Other Diseases of the Stomach (Cancer exc-pted)									1					1
3. Infantile Diarrhea and Gastro-enteritis ("Cholera Infantum")	5	6	1	10			2	14	2	6	1		1	1
4. Diarrhea and Enteritis (not infantile)		1	1				2	2		1				
5. Dysentery		1			1			1		1				
6. Hernia and Intestinal obstructions				1	2		1	1		3				

15.
Diseases by Towns in 1898

North Bay.	Orangeville.	Owen Sound.	Parry Sound.	Peterborough.	Pembroke.	Perth.	Picton.	Port Arthur.	Rat Portage.	Sarnia.	Sault Ste. Marie.	Simcoe.	Toronto Junction.	Walkerton.	Welland.	Whitby.	Woodstock.	Total
1	1	4	2	7	4		1		12	5			1				2	57
				1	1				1									5
					1				2				1					9
		4																14
		1	3	2		1		1	1	2		1	4			1		41
1								1				1				1		7
														1				1
	1	5		2	1	4	2		4	4		2	1		2		5	48
				1									1					4
5	5	12	4	29	11	9	6	6	10	5	8	5	8	4	3	4	11	267
	1	4		8	1	3	3	1	1	3			2	1	1	4	3	69
	1			1		1			1		1	1						9
				1			1		2				1				1	9
		1																12
												1						3
				1	2			1	1	2					1			14
		4		2			2			1	1		1	1			2	21
		2			2			1				2		2	1		1	15
			1	5	3	1		3	2		1	1		2	2	1	2	58
							1										1	5
	4	5		3	1	2	2	1	1	3	3	2	3	3	3		2	54
				2	2									1				3
4		1	3	5	3				2	5			4		1	2	2	6
	1			1														50
																		7
		1	1		1								1	1				3
	1	13	3	11	5		2	2	3	1	2	2		1	1			3
										1								5
			1	2		1												4
	3			3		1	4	1	2	1		2			2		1	32
				3		1		3	2	4	1	1	2			1		34
							1							1		1	1	10
1		1			6	1	1	3	2	1	4	1	2	1			3	16
1	1	7								1							12	95
																		1
1					1					1	1	2	1			1	2	16
	1																1	3
													1					2
										1								1
																		7
2		8	3	4	5	1	1		7	4	4	5	11	1	3	2	3	113
1		1		2					1	1				1	3		1	18
	1	1		1		1						1		1				6
												1						12

TABLE

General Diseases.	Barrie.	Berlin.	Bracebridge.	Brockville.	Brampton.	Clayton.	Cobourg.	Cornwall.	Goderich.	Lindsay.	L'Orignal.	Milton.	Napanee.	Niagara Falls.
VI.—DISEASES OF THE DIGESTIVE SYSTEM.—Continued.														
7. Other Diseases of the Intestines ..	1	1												
8. Diseases of the Liver ..		1						2	1	1		1		3
9. Peritonitis (not puerperal) ..	1	2		1					1					1
10. Iliac abscess (typhlitis, perityphlitis, appendicitis) ..	1	1	1					1		1				2
VII.—DISEASES OF THE GENITO-URINARY SYSTEM.														
1. Acute Nephritis ..				2				1	1					
2. Bright's Disease ..	3	7		5			3	7		1			2	
3. Other Diseases of the Kidneys and Adnexa ..														
4. Vesical Calculi ..									1					
5. Diseases of the Bladder ..				1			1							
6. Diseases of the male Genital Organs ..														
7. Metritis ..														
8. Other Diseases of the Uterus ..														
VIII.—PUERPERAL DISEASES.														
1. Puerperal Septicaemia ..		1												
2. Puerperal Albuminuria and Convulsions ..														
3. Other accidents of Pregnancy sudden death ..				1			1							
4. Puerperal Disease of the Breast ..														
IX.—DISEASES OF THE SKIN AND CELLULAR TISSUE.														
1. Erysipelas ..					1									
2. Other Diseases of the Skin and its Adnexa (Cancer excepted) ..														
X.—DISEASES OF THE LOCOMOTOR SYSTEM.														
1. Pott's Disease ..														
2. Diseases of Bones and Joints ..														
3. Amputation (for unspecified Disease) ..														
XI.—MALFORMATIONS, DISEASES OF INFANCY, DISEASES OF OLD AGE.														
1. Still-Births ..	5	8			2			1		4				1
2. Congenital Debility and Malformations ..	4	10	3	13	2		6	10		9	1		4	7
3. Other Diseases of Infancy ..									1					
4. Senile Decay ..	10	11	3	12	4		15	9	7	10		1	6	2
XII.—SUICIDE.														
1. Poison ..				1										
2. Strangulation ..														
3. Gas Poisoning ..														
4. Drowning ..														
5. Firearms ..														
XIII.—ACCIDENT.														
1. Poison ..												1		
2. Fractures and Dislocations ..	1	2		2			1		1				1	1
3. Gun-shot ..														
4. Drowning ..	1	1		1				2	1	2				
5. Electric Cars ..														
6. Bicycles ..														
7. Railways ..	1			5			1							
8. Burns and Scalds ..		1					1	2						
9. Hanging ..			1											
XIV.—ILL-DEFINED CAUSES.														
1. Dropsy ..		3		1			1						5	
2. Tumors ..	1	2		3			1	2	2	2				
3. Other Ill-Defined Causes ..	1	2				1		2	1					
Total ..	80	113	23	160	41	7	91	118	42	90	4	18	46	45

15.—Continued.

North Bay.	Orangeville.	Owen Sound.	Parry Sound.	Peterborough.	Pembroke.	Perth.	Picton.	Port Arthur.	Rab Portage.	Sarnia.	Sault Ste. Marie.	Simcoe.	Toronto Junction.	Walkerton.	Welland.	Whitby.	Woodstock.	Total.
.....	1	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
.....	2	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	22
.....	1	1	1	2	1	.....	1	.....	.....	1	.....	.....	2	.....	.....	.....	1	17
.....	1	1	.....	.....	.....	1	1	2	2	.....	.....	.....	.....	.....	1	16
.....
.....	2	2	.....	3	1	.....	.....	1	1	.....	.....	.....	.....	.....	.....	.....	2	8
.....	3	3	.....	.....	2	3	1	2	.....	1	1	1	.....	3	54
.....
.....	1	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	2
.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5
.....	1	.....	.....	1	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	3
.....	1	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	4
.....	1	.....	.....	.....	1	2
.....	1	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	3	7
.....
.....	1	.....	.....	1	.....	.....	3
.....
.....	1	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	1	3
.....
1	7	2	9	.....	.....	.....	3	5	7	4	.....	6	1	1	.....	6	73
7	9	3	8	7	6	2	5	6	7	8	1	8	1	2	5	3	157
3	4	16	.....	10	4	4	10	1	.....	9	3	4	2	7	3	6	9	1
.....	185
.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	1	4
.....
.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	2
.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
.....
1	1	1	2	1	.....	2	3	5	3	2	1	.....	1	1	.....	.....	3
.....	1	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	31
1	3	2	3	1	1	2	.....	3	1	.....	.....	1	.....	.....	.....	.....	3
.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25
.....	1
.....	2	1	1	2	1	.....	1	1	.....	.....	1	.....	2
.....	1	1	1	.....	.....	.....	.....	.....	.....	16
.....	7
.....	1
.....	2	1	.....	.....	.....	.....	.....	1	2	1	.....	1	18
.....	1	.....	2	.....	.....	2	.....	2	.....	.....	.....	.....	1	.....	.....	1	21
.....	1	.....	.....	.....	.....	1	2	.....	.....	.....	1	.....	.....	.....	13
1	29	123	33	154	66	43	53	45	86	90	44	40	71	37	28	35	105	1,991

TABLE
Deaths from Consumption in

Counties.	Accountants.	Architects.	Attorneys.	Barbers.	Blacksmiths.	Bookkeepers.	Brokers.	Blacksmiths.	Bucksmiths.	Bankers.	Builders and contractors.	Carpenters.	Cabinetmakers.	Coppers.	Cooks.	Chemists and druggists.	Clergymen.	Carriage and wagonmakers.	Clerks.	Cheesemakers.	Cigar-makers.	Commercial travellers.	Children under 10 years old.		
Algoma	1																						2		
Brant																							10		
Bruce									1														12		
Carleton				2		1				1		4						2				2	33		
Dufferin																							5		
Elgin					1	1															1		4		
Essex																							13		
Frontenac			2		1			2	1			1					1						5		
Grey						1						1							2				8		
Haldimand				1																			2		
Haliburton																							1		
Hastings																							4		
Huron				1		1			1										2				8		
Kent				2															1				9		
Lambton												1							1				8		
Lanark								2											1				6		
Leeds and Grenville			1	1								1	1			1		1	2	1			5		
Lennox and Addington	1				1																		18		
Lincoln								1				1		1		1							6		
Middlesex						1	1	1					1					2	2			1	12		
Muskoka																			2				3		
Norfolk																							8		
Northumberland and Durham																	1	2					12		
Nipissing																							6		
Ontario				1										1					1				11		
Oxford				1		3						1	1										7		
Peel								1															4		
Perth	1																1						9		
Peterborough						1												3					11		
Prescott and Russell																							3		
Prince Edward																		1					6		
Parry Sound								2															6		
Rainy River																							6		
Renfrew						1						1							2				1		
Stormont, Dundas and Glengarry				1		1																	7		
Simcoe	1		1											1		1							10		
Thunder Bay																		1					6		
Victoria					1																		8		
Waterloo				1								1						1					3		
Welland																							6		
Wellington						1		1				1							1			1	2		
Wentworth						2		1				1			1			4					21		
York	2	1	2	3	3	1	2				1	4				1	1	14		1	1		149		
Totals	5	1	2	6	16	7	3	19	3	12	2	1	1	21	3	3	1	4	4	7	45	1	3	7	471

Ontario by Occupations in 1898.

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TABLE No. 16.—*Concluded.*

Deaths from Consumption in Ontario by Occupations in 1898.

Counties.	Public officials.	Police-men.	Railroad employes.	Servants.	Students.	Stonecutters.	Shoemakers.	Sailors.	Seamstresses.	School teachers.	Spinners.	Tailors.	Tinsmiths.	Teamsters.	Telephone operators.	Telephone operators.	Tanners and curriers.	Volunteers, soldiers and pensioners.	Undertakers.	Veterinary surgeons.	Watchmakers and jewellers.	Weavers.	No occupation given.
Algoma.....				2	1			1			2												2
Brant.....				1							12												6
Bruce.....					1						8	2											7
Carleton.....	4		2	8	4		1		1		27	1		3							1		26
Dufferin.....			1	1							1												7
Elgin.....				1	1						1	1											8
Essex.....			1	2	1			2	12				1										17
Frontenac.....				2	1				12								1						28
Grey.....				2				2		1													27
Haldimand.....																							6
Haliburton.....																							1
Halton.....					1						1												3
Hastings.....					1																		19
Huron.....											19				1								5
Kent.....				1	1		1																26
Lambton.....	1				1																		13
Lanark.....			1	1	1							1		1	1								14
Leeds and Grenville.....			1	2	4				1				1	1									32
Lennox and Addington.....	1												1										9
Lincoln.....				3	2	1		1	1														4
Middlesex.....			1	1	3	1	1				1		1	1	1	1							32
Muskoka.....						1																	5
Norfolk.....																1							7
Northumberland and Durham.....					2		1		1			1		1						1			19
Nipissing.....					1						4												5
Ontario.....				1	1				1		5												7
Oxford.....			1	1	1				2		3	1											3
Peel.....					1	3													1				12
Perth.....			1	2	1	1			2		14	1											8
Peterborough.....			1		1																1		17
Prescott and Russell.....									1														25
Prince Edward.....								1															6
Parry Sound.....											2												3
Rainy River.....											1												4
Renfrew.....				4							5												11
Stormont, Dundas and Glengarry.....	1	1		1					2		8							1					23
Simcoe.....				1				1	3		14	1								1			29
Thunder Bay.....							1																1
Victoria.....					2						11				1								7
Waterloo.....																							9
Welland.....	1		2			1							1										5
Wellington.....					1				1	4													11
Wentworth.....				1	1				1		2		1								2		41
York.....	1	2	14	7	2	3	1	4	1		1		2							1	2		116
Totals.....	7	3	12	51	42	11	9	9	14	20	131	12	3	10	3	2	2	1	1	1	6	3	666

APPENDIX.

BIRTHS.

BIRTHS BY MONTHS, 1898.—COUNTIES.

Counties.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	No. of pairs.	Triplets.	Quadruplets.	Illegitimate.	Still born.
Albion:																		
Males	33	38	41	45	41	33	34	35	29	39	26	31	425	5	.....	.....	3	6
Females	31	35	39	34	35	29	32	42	31	21	39	24	392	11	.....	.....	2	2
Total	64	73	80	79	76	62	66	77	60	60	65	55	817	8 pair	.....	.....	5	8
Brant:																		
Males	27	32	38	28	37	33	31	29	33	42	30	32	392	7	.....	.....	8	7
Females	28	23	22	22	25	31	23	34	26	27	22	27	310	8	.....	.....	3	4
Total	55	55	60	50	62	64	54	63	59	69	52	59	702	5 pair	.....	.....	11	11
Bruce:																		
Males	56	54	49	62	58	61	40	71	68	46	52	50	667	3	.....	.....	5	12
Females	73	46	59	57	41	42	67	65	50	52	47	44	643	9	.....	.....	8	7
Total	129	100	108	119	99	103	107	136	118	98	99	94	1,310	6 pair	.....	.....	13	19
Carlisle:																		
Males	104	93	89	94	88	95	101	110	87	88	80	93	1,112	14	.....	.....	9	11
Females	103	79	92	97	105	80	90	92	90	79	81	83	1,071	22	3	.....	11	6
Total	207	172	181	191	193	175	191	192	177	167	161	176	2,183	18 pair	1 case	.....	20	17
Dufferin:																		
Males	17	22	22	24	18	19	25	15	16	20	14	17	229	2	.....	.....	1	2
Females	9	15	18	18	28	17	22	21	21	22	15	14	220	2	.....	.....	2	1
Total	26	37	40	42	46	36	47	36	37	42	29	31	449	2 pair	.....	.....	3	3
Elgin:																		
Males	35	31	34	35	37	30	33	30	44	38	35	30	412	4	.....	.....	.....	4
Females	24	32	32	35	26	35	30	36	22	29	24	26	351	2	.....	.....	2	4
Total	59	63	66	70	63	65	63	66	65	67	59	56	763	3 pair	.....	.....	2	8
Essex:																		
Males	68	72	71	70	53	58	83	77	76	56	59	61	804	18	.....	.....	4	9
Females	55	65	71	66	74	55	78	78	74	74	52	61	803	12	.....	.....	4	7
Total	123	137	142	136	127	113	161	155	150	130	111	122	1,607	15 pair	.....	.....	8	16

Frontenac :	44	31	46	46	38	39	49	42	36	30	35	49	484	3	2	8	3
Males	31	38	44	46	39	36	36	47	32	28	24	34	135	3	22	16	3
Females.....	75	69	89	92	77	75	85	89	68	58	59	83	919	3 pair	1 case	24	6
Total																	
Grey :																	
Males	51	56	78	60	60	56	81	69	63	79	41	54	751	19		1	9
Females.....	61	58	64	64	51	47	66	62	65	47	44	46	676	7		6	5
Total	112	114	142	124	111	103	147	131	128	126	88	100	1,426	13 pair		7	14
Haliburton :																	
Males	7	9	14	9	13	9	7	14	10	9	8	6	115	1		1	1
Females.....	2	6	8	9	10	14	9	7	12	12	9	9	107	3		1	1
Total	9	15	22	18	23	23	16	21	22	21	17	15	222	2 pair		2	2
Haldimand :																	
Males	11	17	22	15	18	20	12	17	22	17	15	19	205	2		3	3
Females.....	11	17	18	18	9	18	19	23	16	20	13	16	198			4	2
Total	22	34	40	33	27	38	31	40	38	37	28	35	403	1 pair		7	5
Halton :																	
Males	17	11	23	19	16	11	16	20	14	16	16	16	195	3		3	4
Females.....	13	19	23	16	15	19	15	19	19	19	18	20	215	1		2	5
Total	30	30	46	35	31	30	31	39	33	35	31	36	410	2 pair		5	9
Hastings :																	
Males	51	47	55	53	48	54	57	64	69	46	56	46	646	13		4	6
Females.....	56	36	49	39	38	49	42	59	66	51	35	36	556	11		2	3
Total	107	83	104	92	86	103	99	123	135	97	91	82	1,202	12 pair		6	9
Huron :																	
Males	49	47	48	58	51	58	58	67	51	57	50	49	643	10	2	5	7
Females.....	60	54	62	54	52	59	52	67	48	50	38	39	635	8	1	4	7
Total	109	101	110	112	103	117	110	134	99	107	88	88	1,278	9 pair	1 case	9	11
Kent :																	
Males	42	67	56	64	63	54	61	50	62	43	46	51	659	4	2	4	1
Females.....	51	55	65	37	59	47	57	62	57	52	53	59	654	10	1	5	6
Total	93	122	121	101	122	101	118	112	119	95	99	116	1,313	7 pair	1 case	9	7

BIRTHS BY MONTHS, 1898.—COUNTIES.—Continued.

Counties.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	No. of pairs.	Triplets.	Quadruplets.	Illegitimate.	Still born.
Lambton:																		
Males	61	51	58	55	41	47	51	47	45	50	52	48	606	10	...	...	2	6
Females	37	52	47	47	44	55	42	48	53	50	43	46	564	8	...	...	3	4
Total	98	103	105	102	85	102	93	95	98	100	95	94	1,170	9 pair	...	...	5	10
Lanark:																		
Males	28	24	25	25	30	26	33	46	32	36	29	25	359	2	...	...	6	6
Females	32	29	32	32	27	37	29	39	46	38	24	29	364	12	...	...	4	5
Total	60	53	57	57	57	63	62	85	78	74	53	54	743	7 pair	...	...	10	11
Leeds and Grenville:																		
Males	31	41	52	47	45	36	48	46	62	44	43	36	531	4	...	...	5	8
Females	37	36	59	40	44	43	46	56	50	38	40	42	531	12	...	...	3	2
Total	68	77	111	87	89	79	94	102	112	82	83	78	1,062	8 pair	...	...	7	10
Lennox and Addington:																		
Males	16	18	16	23	23	20	24	29	21	21	14	20	245	4	...	...	3	3
Females	24	14	16	20	17	14	22	18	19	20	16	22	292	4	...	...	1	3
Total	40	32	32	43	40	34	46	47	40	41	30	42	467	4 pair	...	...	4	6
Lincoln:																		
Males	26	20	22	23	26	28	20	21	37	18	35	21	297	2	...	...	3	4
Females	22	27	26	16	30	18	18	16	22	23	19	26	263	4	...	...	9	7
Total	48	47	48	39	56	46	38	37	59	41	54	47	560	3 pair	...	...	12	11
Middlesex:																		
Males	77	59	90	61	67	72	73	82	63	52	49	66	811	8	...	...	6	2
Females	71	72	74	89	71	62	73	69	85	44	38	56	801	10	...	...	6	7
Total	148	131	164	150	138	134	146	151	148	96	87	122	1,615	9 pair	...	...	12	15
Muskoka:																		
Males	23	25	33	32	29	23	22	28	17	31	13	26	302	...	...	...	1	6
Females	19	26	32	32	29	24	25	25	29	21	15	21	299	2	...	...	1	2
Total	42	51	65	64	58	47	47	54	46	52	28	47	601	1 pair	...	...	2	8

Norfolk:	29	31	33	20	16	20	26	21	39	29	21	20	307	4	.....	7	6
Males	27	30	21	33	33	27	28	33	35	22	22	23	334	6	.....	4	6
Females	56	61	56	53	49	47	54	54	74	51	43	43	641	5 pair	.....	11	12
Total																	
Northumbreland and Durham:																	
Males	66	39	61	50	52	46	64	55	70	50	46	51	650	4	.....	9	14
Females	37	41	56	57	38	49	56	62	57	35	38	42	568	10	.....	5	3
Total	103	80	117	107	90	95	120	117	127	85	84	93	1,218	7 pair	.....	14	17
Nipissing:																	
Males	33	45	48	34	43	35	41	39	22	36	12	32	450	5	.....	2	2
Females	34	31	36	35	37	39	33	42	49	37	36	38	417	5	.....	3	3
Total	67	76	84	69	80	74	74	81	71	73	78	70	897	5 pair	.....	5	5
Ontario:																	
Males	54	25	40	39	41	38	41	56	35	30	24	40	463	12	.....	3	25
Females	33	32	30	36	31	29	38	33	38	28	31	32	591	6	.....	3	10
Total	87	57	70	75	72	67	79	89	73	58	55	72	854	9 pair	.....	6	35
Oxford:																	
Males	42	52	60	33	50	35	42	45	52	52	29	35	527	1	1	7	4
Females	42	46	45	56	38	43	44	51	47	35	53	46	516	5	2	8	13
Total	81	98	105	89	88	78	86	96	99	87	82	81	1,073	3 pair	1 case	15	17
Parry Sound:																	
Males	26	24	32	33	26	24	32	30	38	25	23	21	334	7	.....	4	5
Females	28	31	39	48	28	31	25	26	30	16	18	26	316	3	3	3	5
Total	54	55	71	81	54	55	57	56	68	41	41	47	680	5 pair	1 case	7	10
Peel:																	
Males	16	14	17	26	19	11	19	16	17	16	15	19	205	3	.....	1	1
Females	20	21	19	21	19	19	13	18	13	10	16	14	203	1	.....	.....	1
Total	36	35	36	47	38	30	32	34	30	26	31	33	408	2 pair	.....	1	2
Perth:																	
Males	37	34	52	54	48	46	36	54	46	45	33	37	522	9	.....	.....	2
Females	43	39	52	35	40	40	28	44	44	47	23	42	477	3	.....	4	2
Total	80	73	104	89	88	86	64	98	90	92	56	79	999	6 pair	.....	4	4

BIRTHS BY MONTHS, 1898.—COUNTIES.—*Concluded.*

Counties.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	No. of pairs.	Triples.	Quadruplets.	Illegitimate.	Still born.
Peterborough :																		
Males	31	27	42	38	41	40	38	46	48	30	27	31	439	2	.....	.....	1	6
Females	22	34	33	37	43	37	30	40	31	28	23	34	392	2	.....	.....	4	7
Total	53	61	75	75	84	77	68	86	79	58	50	65	831	2 pair	.....	.....	5	13
Prescott and Russell :																		
Males	73	58	80	103	81	70	69	60	67	50	58	52	821	11	.....	.....	5	3
Females	72	60	82	74	70	61	60	80	70	69	44	60	802	9	.....	.....	2	8
Total	145	118	162	177	151	131	129	140	137	119	102	112	1,623	10 pair	.....	.....	7	6
Prince Edward :																		
Males	12	12	15	14	14	10	10	11	23	14	15	11	161	3	.....	.....	.....	1
Females	10	12	17	8	14	10	7	10	10	20	13	13	144	3	.....	.....	.....	2
Total	22	24	32	22	28	20	17	21	33	34	28	24	305	3 pair	.....	.....	.....	3
Rainy River :																		
Males	10	9	9	18	16	5	9	4	13	10	7	12	122	.....	.....	.....	1	.....
Females	6	8	9	10	8	13	11	10	9	10	9	10	113	2	.....	.....	3	.....
Total	16	17	18	28	24	18	20	14	22	20	16	22	235	1 pair	.....	.....	4	.....
Renfrew :																		
Males	71	52	70	56	45	53	54	65	55	51	53	60	655	9	1	.....	2	5
Females	65	58	65	50	63	52	60	57	63	42	55	42	672	5	2	.....	8	12
Total	136	110	135	106	108	105	114	122	118	93	108	102	1,327	7 pair	1 case	.....	10	17
Simcoe :																		
Males	63	56	81	81	75	69	78	77	94	89	68	52	883	10	.....	.....	7	16
Females	60	68	90	65	96	75	77	84	81	58	55	52	861	8	.....	.....	2	12
Total	123	124	171	146	171	144	155	161	175	147	123	104	1,744	9 pair	.....	.....	9	28
Stormont, Dundas and Glengarry :																		
Males	52	58	63	43	66	63	64	61	58	56	51	63	698	11	3	.....	7	6
Females	62	55	50	45	52	38	64	51	60	50	46	68	640	9	.....	.....	6	4
Total	114	113	113	88	118	101	128	112	118	106	96	131	1,338	10 pair	1 case	.....	13	10

BIRTHS BY MONTHS, 1898.—CITIES.

Cities.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	No. of pairs of twins.	Triplets.	Quadruplets.	Illegitimate.	Still born.
Toronto:																		
Males.....	176	188	203	165	145	185	187	200	167	181	147	154	2,098	28	.....	.....	154	1
Females.....	149	156	200	172	176	172	175	200	175	147	142	160	2,024	34	.....	.....	127	2
Total.....	325	344	403	337	321	357	362	400	342	328	289	314	4,122	31 pair	.....	.....	281	3
Ottawa:																		
Males.....	55	61	60	56	42	57	71	62	52	57	54	51	678	7	.....	.....	92	5
Females.....	64	53	62	70	60	46	63	45	55	52	56	45	671	7	.....	.....	100	3
Total.....	119	114	122	126	102	103	134	107	107	109	110	96	1,349	7 pair	1 case	.....	192	8
Hamilton:																		
Males.....	51	35	49	48	58	50	51	44	54	45	50	46	581	8	.....	.....	17	29
Females.....	52	38	57	51	47	51	47	45	39	45	41	28	521	8	.....	.....	22	20
Total.....	103	73	106	79	105	101	98	89	93	90	91	74	1,102	8 pair	.....	.....	39	49
London:																		
Males.....	36	33	28	24	30	29	32	29	20	15	14	27	317	7	.....	.....	5	2
Females.....	33	25	22	36	29	26	27	22	33	24	14	19	310	1	.....	.....	4	2
Total.....	69	58	50	60	59	55	59	51	53	39	28	46	627	4 pair	.....	.....	9	4
Kingston:																		
Males.....	24	10	15	14	18	11	17	22	10	11	14	18	184	1	.....	2	5	.....
Females.....	11	13	20	18	15	10	10	19	14	15	11	14	170	1	.....	2	15	.....
Total.....	35	23	35	32	33	21	27	41	24	26	25	32	354	1 pair	.....	1 case	20	.....
Brantford:																		
Males.....	19	18	22	19	17	18	19	22	12	22	19	14	221	.....	.....	.....	6	5
Females.....	13	12	9	10	14	20	15	17	18	16	12	10	166	.....	.....	.....	4	4
Total.....	32	30	31	29	31	38	34	39	30	38	31	24	387	.....	.....	.....	10	9
St. Thomas:																		
Males.....	7	9	7	16	12	13	10	8	7	9	8	4	110	1	.....	.....	.....	.....
Females.....	4	13	11	4	7	10	7	8	3	5	7	10	92	1	.....	.....	2	.....
Total.....	11	22	21	20	19	23	17	16	10	14	15	14	202	1 pair	.....	.....	2	.....

Guelph :	14	14	16	5	10	10	13	17	10	8	11	9	137	3	.....	.....	.....	4	4
Males	11	12	11	8	10	8	8	10	6	15	7	3	109	5	.....	.....	.....	6	3
Females	25	26	27	13	20	18	21	27	16	23	18	12	246	4 pair	.....	.....	.....	10	7
Total																			
St. Catharines :																			
Males	6	5	6	5	6	7	3	5	9	4	6	5	67	1	.....	.....	.....	3	1
Females	7	10	8	5	14	6	8	2	9	9	6	7	91	3	.....	.....	.....	10	4
Total	13	15	14	10	20	13	11	7	18	13	12	12	158	2 pair	.....	.....	.....	13	5
Belleville :																			
Males	8	8	8	8	7	5	8	8	11	5	6	6	88	1	.....	.....	.....	2	2
Females	11	1	7	6	7	4	4	9	10	7	8	7	81	3	.....	.....	.....	2	.....
Total	19	9	15	14	14	9	12	17	21	12	14	13	169	2 pair	.....	.....	.....	4	2
Stratford :																			
Males	7	7	11	5	9	8	11	4	3	6	4	4	79	6	.....	.....	.....	.....	.....
Females	11	7	12	6	7	11	2	4	4	5	3	8	80	2	.....	.....	.....	1	.....
Total	18	14	23	11	16	19	13	8	7	11	7	12	159	4 pair	.....	.....	.....	1	.....
Windsor :																			
Males	12	13	12	6	9	11	10	7	9	8	9	11	117	7	.....	.....	.....	2	.....
Females	7	9	11	8	13	7	10	10	11	8	6	12	112	1	.....	.....	.....	1	1
Total	19	22	23	14	22	18	20	17	20	16	15	23	229	4 pair	.....	.....	.....	3	1
Chatham :																			
Males	7	6	7	3	7	16	5	4	6	2	7	3	73	2	.....	.....	.....	.....	.....
Females	8	5	4	3	8	5	7	8	9	5	8	8	78	2	.....	.....	.....	1	.....
Total	15	11	11	6	15	21	12	12	15	7	15	11	151	2 pair	.....	.....	.....	1	.....
Total Males	422	407	444	374	370	420	437	432	370	373	349	352	4,740	72	.....	.....	.....	2	299
Total Females	381	354	437	377	407	376	383	399	386	353	321	331	4,505	68	.....	.....	.....	3	295
Grand Total	803	761	881	751	777	796	820	831	756	726	670	683	9,235	70 pair	.....	.....	.....	1 case	585
																			88

MARRIAGES.

MARRIAGES BY MONTHS, 1898.

Counties.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	No date given.	Totals.
Algoma	15	11	16	18	7	21	17	11	18	19	20	22	.....	195
Brant	13	17	14	23	13	35	14	18	30	28	23	33	.....	261
Bruce	44	20	33	30	22	38	20	27	35	20	36	45	.....	370
Carleton	56	50	26	52	27	85	48	57	82	68	61	49	.....	661
Dufferin	16	19	27	5	10	18	7	7	12	10	10	11	.....	152
Elgin	16	18	26	29	15	36	16	18	18	18	25	33	.....	268
Essex	87	81	88	85	65	114	87	115	98	94	109	94	.....	1,117
Frontenac	15	27	18	20	19	42	30	22	24	21	27	25	.....	290
Grey	45	30	50	20	28	49	18	22	30	37	36	40	.....	405
Haldimand	12	15	12	14	12	12	9	9	12	16	5	20	.....	148
Hastings	7	9	10	3	1	12	5	4	7	6	12	8	.....	84
Huron .....	.....	.....	1	6	4	7	3	4	1	3	1	3	.....	33
Haliburton .....	.....	.....	44	36	16	33	26	35	41	45	57	62	.....	448
Hastings	18	35	44	36	16	33	26	35	41	45	57	62	.....	448
Huron	25	30	45	21	22	50	8	24	30	41	32	52	.....	380
Kenil	28	32	34	31	24	45	18	27	39	48	54	42	.....	422
Lanark	34	27	29	24	27	29	19	34	38	46	40	51	.....	398
Lanark	24	17	16	20	18	34	16	22	20	23	26	36	.....	272
Leeds and Grenville	44	36	30	26	23	42	25	22	35	41	34	44	.....	402
Lenox and Addington	14	10	21	20	16	16	13	12	15	13	19	14	.....	183
Lincoln	10	10	8	13	12	21	7	10	17	21	20	15	.....	164

Middlesex.....	39	51	41	53	40	66	27	41	62	75	41	79	.....	615
Muskoka	3	5	3	15	7	14	10	9	9	7	11	15	.....	108
Nipissing.....	13	10	5	14	15	20	12	18	22	14	12	12	.....	167
Norfolk	17	8	21	10	14	17	15	19	17	20	18	25	.....	204
Northumberland and Durham	27	35	46	40	29	34	14	21	38	38	40	57	.....	419
Ontario	27	32	23	18	13	22	6	13	19	34	22	28	.....	257
Oxford	34	29	34	33	20	31	13	11	33	22	31	41	.....	332
Parry Sound.....	6	10	9	10	10	12	15	12	11	9	8	9	.....	121
Peel.....	13	9	21	3	6	13	8	4	10	6	6	17	.....	116
Peith.....	30	37	45	37	26	30	11	17	42	30	31	38	.....	374
Peterboro'.....	19	22	19	20	11	42	13	14	33	30	16	23	.....	262
Prescott and Russell.....	32	30	9	22	31	42	34	34	42	41	32	4	.....	353
Prince Edward	9	7	4	6	6	10	6	10	10	18	17	20	.....	123
Rainy River.....	4	3	3	5	7	15	11	12	10	13	15	4	.....	102
Renfrew	32	18	20	34	15	55	28	35	33	29	29	14	.....	342
Simcoe	43	39	53	47	35	54	32	33	52	51	57	48	.....	544
Stormont, Dundas and Glengarry.....	31	41	26	28	23	40	23	37	55	53	44	34	.....	435
Thunder Bay.....	3	8	1	3	5	8	5	4	7	13	9	7	.....	73
Victoria.....	17	21	22	16	11	30	17	8	20	22	23	17	.....	224
Waterloo	23	38	30	23	22	29	22	19	19	28	35	21	.....	309
Welland	26	13	15	20	13	30	15	22	19	36	28	21	.....	258
Wellington.....	29	35	34	24	25	42	16	26	31	28	33	36	.....	359
Wentworth	43	40	18	62	23	68	35	42	65	58	56	56	.....	566
York	130	119	151	158	169	278	128	184	222	195	174	207	4	2,059
Totals.....	1,173	1,154	1,204	1,197	897	1,741	922	1,145	1,483	1,488	1,435	1,532	4	15,375

MARRIAGES BY DENOMINATIONS AND AGES, 1898.

Sex.	Religious denomination of bride and bridegroom.										How married.		Totals.	C. n. n. b. i. s.	Ages.													
	Episcopallians	Presbyterians.	Methodists.	Roman Catholics	Baptists.	Congregationalists.	Lutherans.	Evangelical Association.	Quakers.	Members of other denominations.	No denomination given.	License.			Banns.	Under 20 years of age.	From 20 to 24 years.	From 25 to 34 years.	From 35 to 39 years.	From 40 to 44 years.	From 45 to 49 years.	From 50 to 54 years.	From 55 to 59 years.	From 60 to 64 years.	65 to 69 years.	70 yrs and over.	Ages not given.	
Males... Females... Total.	23 26 49	67 64 131	60 60 120	33 34 67	3 8 11	2 2 4	2 2 4	2 2 4	1 1 2	5 2 7	1 1 2	.....	.....	{ Algoma..... }	8 55 63	55 87 142	72 24 96	37 14 51	11 7 18	3 2 5	3 1 4	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	5 5 10	
Males... Females... Total.	40 40 80	54 49 103	100 102 202	11 9 20	36 43 79	7 9 16	1 1 1	10 11 21	5 1 6	5 9 18	3 9 18	.....	.....	{ Brant..... }	5 32 37	99 121 220	85 63 148	32 23 55	21 12 33	8 12 20	5 2 7	3 1 3	2 1 3	1 1 1	1 1 1	1 1 1	3 4 7	
Males... Females... Total.	48 45 93	122 120 242	120 121 241	35 35 70	13 13 26	2 2 4	10 13 23	10 11 21	5 1 6	5 9 14	5 9 14	.....	.....	{ Bruce..... }	3 55 58	99 167 266	154 98 252	62 25 87	27 15 42	8 4 12	6 2 8	3 1 4	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	
Males... Females... Total.	158 130 288	118 123 241	87 80 167	250 273 523	12 16 28	4 2 6	15 13 28	15 13 28	16 22 38	16 22 38	16 22 38	.....	.....	{ Carleton..... }	30 160 190	235 295 530	191 133 324	98 64 162	38 22 60	30 20 50	14 8 22	14 7 21	2 5 8	4 1 5	3 1 1	1 1 1	1 1 1	
Males... Females... Total.	27 27 54	51 50 101	56 60 116	6 4 10	6 4 10	6 4 10	6 4 10	6 4 10	1 1 2	8 11 19	8 11 19	.....	.....	{ Dufferin..... }	1 20 21	31 65 96	63 39 104	27 18 45	14 6 20	3 3 6	5 5 10	3 3 6	1 1 2	1 1 2	1 1 2	1 1 2	1 1 2	
Males... Females... Total.	36 25 61	40 44 84	128 120 248	5 7 12	42 49 91	4 1 5	4 1 5	4 1 5	2 2 4	10 11 21	5 7 12	.....	.....	{ Elgin..... }	2 36 38	81 102 183	88 74 162	39 30 69	23 9 32	13 6 19	6 3 9	7 1 8	5 4 9	1 1 2	1 1 2	1 1 2	1 1 2	

Males ..	172	155	314	237	93	29	78	1	...	37	6	...	...	1117	{ Essex	...	33	455	320	150	69	33	21	13	14	5	2	2
Females ..	188	133	297	257	107	23	70	3	...	35	4	...	...	1117	{ Essex	...	278	470	191	85	38	29	11	4	1	1	...	9
Total.	360	288	611	494	200	52	143	4	...	72	10	1038	79	2234	{ Essex	...	311	925	511	235	107	62	32	17	15	6	2	11
Males ..	63	44	121	43	5	6	...	1	...	4	3	...	...	290	{ Frontenac	...	6	95	91	47	21	3	13	5	5	2	1	1
Females ..	54	49	114	51	10	1	...	...	...	4	4	...	...	290	{ Frontenac	...	48	114	56	34	18	3	6	3	3	...	1	4
Total.	117	93	235	97	15	7	...	1	...	8	7	267	23	580	{ Frontenac	...	54	209	147	81	39	6	19	8	8	2	1	5
Males ..	42	133	133	28	24	...	25	2	...	7	6	...	...	405	{ Grey	...	...	108	154	81	33	12	5	3	2	2	3	2
Females ..	36	140	139	27	20	...	29	2	1	7	4	...	...	405	{ Grey	...	50	188	100	38	14	5	3	1	1	1	...	4
Total.	78	273	277	55	44	...	54	4	1	14	10	372	33	810	{ Grey	...	50	296	254	119	47	17	8	4	3	3	3	6
Males ..	16	26	60	8	19	1	3	2	...	5	7	...	...	148	{ Haldimand	...	2	43	45	25	14	9	4	3	1	...	1	1
Females ..	19	24	59	10	21	...	2	2	...	7	2	...	...	148	{ Haldimand	...	33	61	26	17	6	1	3	...	...	...	1	...
Total.	35	50	119	18	40	1	5	4	...	12	9	143	5	296	{ Haldimand	...	35	104	71	42	20	10	7	3	1	...	1	1
Males ..	16	26	33	3	3	1	...	...	...	2	...	...	...	84	{ Halton	...	...	17	36	18	8	1	2	1	...	1	...	...
Females ..	15	28	80	3	4	1	...	...	...	3	...	...	...	84	{ Halton	...	11	28	26	13	1	3	1	...	...	...	...	1
Total.	31	54	63	6	7	2	...	...	...	5	...	82	3	168	{ Halton	...	11	45	62	31	9	4	3	1	...	1	...	1
Males ..	9	6	16	...	1	...	...	...	...	1	...	...	...	33	{ Haliburton	...	...	9	16	4	2	1	1	...	...	...	...	...
Females ..	5	8	17	...	...	...	...	...	...	2	1	...	...	33	{ Haliburton	...	14	15	3	...	...	...	1	...	...	...	...	...
Total.	14	14	33	...	1	...	...	...	...	3	1	33	...	66	{ Haliburton	...	14	24	19	4	2	1	2	...	...	...	...	...
Males ..	73	60	211	41	11	1	...	...	...	7	41	...	...	448	{ Hastings	...	8	151	155	63	38	10	8	4	4	4	...	1
Females ..	59	55	222	38	6	...	...	...	...	6	62	...	...	448	{ Hastings	...	89	207	92	30	11	4	3	4	4	1	1	2
Total.	132	115	433	82	17	1	...	...	...	13	103	421	27	896	{ Hastings	...	97	358	247	93	49	14	11	8	8	5	1	3
Males ..	37	130	152	22	7	1	11	8	...	2	6	4	...	380	{ Huron	...	1	79	165	66	36	15	6	2	1	1	2	5
Females ..	28	133	163	22	5	1	10	10	...	1	6	1	...	386	{ Huron	...	35	148	115	46	20	5	...	2	1	...	...	8
Total.	65	263	315	44	12	2	21	18	...	3	12	5	356	700	{ Huron	...	36	227	280	112	56	20	6	4	2	1	1	2
Males ..	44	81	166	69	37	1	2	1	...	15	5	...	...	422	{ Kent	...	10	156	126	53	28	17	13	1	6	2	4	4
Females ..	38	73	171	69	46	1	...	...	...	17	8	...	...	422	{ Kent	...	99	171	71	29	23	4	7	5	...	1	1	10
Total.	82	154	337	148	82	2	2	1	1	32	13	383	39	844	{ Kent	...	109	327	197	82	51	21	20	6	6	3	5	3

MARRIAGES BY DENOMINATIONS AND AGES; 1898.—Continued.

Sex.	Religious denomination of bride and bridegroom.											How married.	Totals.	Counties.	Ages.														
	Episcopali-ans.	Pre-byteri-ans.	Methodists.	Roman Catholics	Baptists.	Congrega- tionalists.	Lutherans.	Evangelical Association.	Quakers.	Mennonites.	Other denominations.				No denomi- nation given.	License.	Banns.	Under 20 years of age.	From 20 to 24 years.	From 25 to 29 years.	From 30 to 34 years.	From 35 to 39 years.	From 40 to 44 years.	From 45 to 49 years.	From 50 to 54 years.	From 55 to 59 years.	From 60 to 64 years.	From 65 to 69. years.	70 yrs and over.	Ages not given.
Males	54	86	173	18	44	11	2	2	8	2	398	} Lambton	14	132	134	64	25	8	7	5	2	3	1	2	1	2	1	2	
Females....	49	90	165	19	42	13	3	6	11	6	398		67	170	103	32	7	10	2	1	1	2	1	1	2	1	2	1	2
Total.....	103	176	338	37	86	24	5	8	19	8	796		81	302	237	96	32	18	9	6	3	5	2	2	3	5	2	2	3
Males	45	112	60	33	10	7	7	5	5	5	272	} Lanark	5	88	88	39	23	9	4	8	3	3	1	..	..	..	1	5
Females....	59	96	60	36	11	6	6	4	4	4	272		30	124	66	21	9	7	3	2	4	1	..	..	..	1	..	5
Total.....	104	208	120	69	21	13	13	9	9	9	544		35	212	154	60	32	16	7	10	7	4	1	..	..	..	6	6
Males	100	63	172	39	16	1	1	6	6	5	402	} Leeds and Grenville. ...	1	134	135	57	32	15	9	6	9	1	1	2	..	..	2	2
Females....	86	56	182	44	21	1	1	5	6	6	402		66	180	81	38	16	9	3	4	2	1	4	..	..	3	..	2
Total.....	186	119	354	83	37	2	2	11	11	11	804		67	314	216	95	48	24	12	10	11	2	1	2	1	2	2	2	
Males	19	21	120	19	1	1	1	3	3	3	183	} Lennox and Addington..	4	56	59	27	14	7	6	2	1	4	..	3	..	..	2	
Females....	17	21	125	16	1	1	1	1	2	2	183		44	63	45	12	6	3	2	2	2	2	2	..	..	4	..	2
Total.....	36	42	245	35	2	2	2	4	5	5	366		48	119	104	39	20	10	8	4	1	8	..	3	2	2	2	2	
Males	31	24	65	15	18	1	2	5	1	1	164	} Lincoln .....	....	53	61	26	8	7	2	2	3	..	..	2	..	..	1	
Females....	22	26	70	10	18	1	3	3	7	3	164		23	72	37	18	5	2	2	2	2	2	2	..	..	2	..	1
Total.....	53	50	135	25	36	2	5	8	8	4	328		22	125	98	44	13	9	2	4	5	2	2	2	2	2	2	1	
Males	142	140	230	30	50	1	3	..	2	..	615	} Middlesex.....	16	191	201	106	40	20	17	5	7	6	2	1	3	3	3		
Females....	130	127	227	25	69	..	2	1	1	1	615		77	262	161	69	22	16	9	2	2	2	2	2	4	..	..	1
Total.....	272	267	457	55	119	1	3	2	3	48	1230		93	453	362	175	62	36	26	7	9	10	2	1	4	4	4	4	

MARRIAGES BY DENOMINATIONS AND AGES.—*Continued.*

Sex.	Religious denomination of bride and bridegroom.											How married.	Countries.	Ages.																	
	Episcopalian.	Presbyterians.	Methodists.	Roman Catholics	Baptists.	Congregationalists.	Lutherans.	Evangelical Association.	Quakers.	Mennonites.	Other denominations.			No denomination.	License.	Banns.	Totals.	Under 20 years of age.	From 20 to 24 years.	From 25 to 29 years.	From 30 to 34 years.	From 35 to 39 years.	From 40 to 44 years.	From 45 to 49 years.	From 50 to 54 years.	From 55 to 59 years.	From 60 to 64 years.	65 to 69 years.	70 yrs and over.	Ages not given.	
Males	49	50	106	41	14	1	.....	.....	.....	.....	1	.....	.....	.....	262	3	76	100	45	18	6	3	6	1	2	1	1	1	.....	
Females....	34	47	109	46	20	2	.....	.....	.....	.....	2	.....	.....	.....	262	35	108	84	18	10	8	.....	2	1	.....	.....	.....	.....	.....
Total ..	83	97	215	87	34	3	.....	.....	.....	.....	3	.....	.....	.....	524	38	184	184	63	28	9	3	8	2	2	1	1	1	1	.....
Males	10	28	13	284	16	.....	.....	.....	.....	.....	2	.....	.....	.....	353	7	163	95	40	25	4	5	4	3	2	.....	.....	.....	5	.....
Females....	16	25	13	288	9	.....	.....	.....	.....	.....	2	.....	.....	.....	353	96	166	50	14	10	7	3	.....	2	.....	.....	.....	.....	5	.....
Total ..	26	53	26	572	25	.....	.....	.....	.....	.....	4	.....	.....	.....	706	103	329	145	54	35	11	8	4	5	2	.....	.....	.....	10	.....
Males	18	5	90	3	1	2	.....	.....	3	.....	1	.....	.....	.....	123	9	53	33	8	6	4	2	3	2	1	1	1	.....	.....	.....
Females....	13	5	102	1	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	123	23	56	22	11	2	2	2	5	.....	.....	.....	.....	.....	.....	.....
Total ..	31	10	192	4	1	2	.....	.....	4	.....	1	1	122	1	246	32	109	55	19	8	6	4	8	2	1	1	1	.....	.....	.....
Males	40	24	7	14	7	1	7	.....	.....	.....	2	.....	.....	.....	102	2	21	32	22	10	7	1	.....	.....	1	1	.....	5	.....	6	.....
Females....	39	24	7	13	7	1	8	.....	.....	.....	1	2	.....	.....	102	18	40	20	10	6	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total ..	79	48	14	27	14	2	15	.....	.....	.....	3	2	89	13	204	20	61	52	32	16	9	1	.....	1	1	1	1	11	.....	.....	.....
Males	33	93	47	123	16	1	18	7	.....	.....	2	.....	.....	.....	342	1	83	138	62	28	15	2	5	1	3	.....	.....	4	.....	.....	.....
Females....	26	87	51	122	24	1	22	3	.....	.....	2	4	.....	.....	342	57	172	67	23	7	4	4	.....	1	1	.....	.....	.....	.....	6	.....
Total ..	59	180	98	245	40	2	40	10	.....	.....	4	6	236	106	684	58	255	205	85	35	19	6	5	2	4	.....	.....	10	.....	.....	.....
Males	92	144	156	110	16	2	2	.....	.....	5	11	6	.....	.....	544	28	169	181	82	40	18	10	5	4	2	1	1	3	.....	.....	.....
Females....	97	189	172	107	8	6	2	.....	1	4	11	7	.....	.....	544	97	221	126	50	21	8	8	3	2	.....	2	.....	6	.....	.....	.....
Total ..	179	283	328	217	24	8	4	.....	1	9	22	13	454	90	1088	125	390	307	132	61	26	18	8	6	2	3	1	9	.....	.....	.....

Males	52	115	95	135	12	1	18	.....	6	1	.....	.....	435	{ Stormont, Dun- glas & Glengarry }	16	172	122	59	30	11	9	3	3	3	2	2	.....	6	7
Females	41	122	101	136	12	1	13	.....	4	5	.....	.....	485		79	206	76	33	16	8	3	3	3	3	1	.....	.....	.....	.....
Total	93	237	196	271	24	2	31	.....	10	6	324	111	870		95	378	198	92	46	19	12	6	6	6	3	2	.....	13	.....
Males	10	18	12	23	2	.....	5	.....	3	.....	.....	.....	73	{ Thunder Bay... }	2	19	25	17	7	1	.....	.....	.....	.....	.....	.....	.....	1	.....
Females	7	16	12	25	4	.....	5	.....	2	.....	.....	.....	73		16	23	23	6	3	.....	.....	.....	.....	.....	.....	.....	.....	2	.....
Total	17	34	24	48	6	.....	10	.....	5	2	55	18	146		18	42	48	23	10	1	.....	.....	.....	.....	.....	.....	.....	3	.....
Males	29	44	118	26	5	.....	.....	.....	2	.....	.....	.....	224	{ Victoria..... }	1	60	71	56	19	8	5	2	1	1	1	1	.....	.....	.....
Females	29	39	113	26	8	.....	.....	.....	9	.....	.....	.....	224		31	99	57	18	12	2	3	.....	.....	.....	.....	.....	.....	2	.....
Total	58	83	231	52	13	.....	.....	.....	11	.....	204	20	448		32	259	128	73	31	10	8	2	1	1	1	1	.....	2	.....
Males	23	52	53	36	13	.....	63	12	31	13	.....	.....	309	{ Waterloo ... }	1	100	117	38	22	13	6	2	2	2	5	2	1	.....	.....
Females	14	53	51	39	12	1	71	15	30	8	16	.....	309		44	145	76	19	13	4	3	3	1	1	1	.....	.....	.....
Total	37	105	104	75	25	3	134	28	61	21	25	241	618		45	245	193	57	35	17	9	5	3	6	2	1	.....	.....	.....
Males	35	49	75	33	21	1	12	1	5	23	1	.....	258	{ Welland..... }	6	78	70	40	30	11	10	6	2	1	1	1	.....	3	.....
Females	45	43	64	34	26	3	8	1	4	22	7	.....	258		45	85	60	28	21	4	5	.....	.....	.....	.....	.....	.....	7	.....
Total	80	92	139	67	47	4	20	2	3	45	8	239	516		51	163	130	68	51	15	15	6	4	1	1	1	.....	10	.....
Males	41	118	113	42	10	7	.....	4	3	21	.....	.....	395	{ Wellington ... }	2	63	135	76	34	22	13	7	1	1	2	1	.....	.....	.....
Females	32	119	124	19	7	4	3	2	4	12	3	.....	359		23	135	127	37	17	10	4	4	.....	.....	.....	.....	.....	2	.....
Total	73	237	237	91	17	11	3	6	7	33	3	322	718		25	198	262	115	51	32	17	11	1	1	2	1	.....	.....	.....
Males	109	128	203	55	35	4	3	1	.....	25	3	.....	506	{ Wentworth ... }	8	186	188	83	46	22	16	5	4	4	2	.....	.....	2	.....
Females	110	108	208	62	34	3	6	1	.....	27	7	.....	566		80	227	150	49	31	12	5	.....	1	2	.....	.....	.....	9	.....
Total	219	236	411	117	69	7	9	2	.....	52	10	557	1132		88	413	338	132	77	34	21	5	5	6	2	.....	.....	11	.....
Males	540	442	636	173	140	37	12	2	5	68	5	.....	2059	{ York	27	617	700	370	149	65	50	32	14	17	9	2	.....	7	.....
Females	569	385	636	201	144	28	5	2	4	75	10	.....	2059		261	904	527	183	92	46	20	14	7	5	2	.....	.....	8	.....
Total	1109	827	1271	374	284	65	17	4	9	143	15	1955	4118		278	1521	1227	553	241	111	70	46	21	22	11	2	.....	15	.....
Males	2519	3785	5165	2272	916	146	366	75	17	408	136	.....	15375	{ Grand total	283	4832	5227	2464	1131	508	331	193	124	99	57	39	.....	94	.....
Females	2383	3115	5217	2385	992	125	357	82	15	445	202	.....	15375		2489	6562	3595	1327	613	274	149	89	60	34	17	1	.....	165	.....
Total	4902	6400	10382	4657	1908	271	723	157	32	127	338	13738	30750		2772	11394	8922	3791	1744	782	480	284	184	124	74	40	.....	259	.....

DEATHS.

CAUSES OF DEATHS BY COUNTIES IN 1898.—ALGOMA.—POPULATION, 17,810. (Including Municipalities of all classes.)

General Diseases.		Number of Column.	Sex.		Nativity.		Soc. con.		Ages.										Months.												Total.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
			Male.	Female.	Canada.	Foreign.	Not sta.	Single.	Married.	Not sta.	Under 5.					Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
											0-1	1-2	2-3	3-4	5-9													10-14	15-19	20-24		25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80 & ov.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
I. COMMUNICABLE DISEASES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
1.	Typhoid Fever.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

ALGOMA.—Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IX. THE SKIN.																																												
1. Erysipelas																																												
2. Skin and Adnexa (Cancer exp'd)																																												
X. LOCOMOTOR SYSTEM. Total																																												
1. Pott's Disease																																												
2. Diseases of Bones and Joints																																												
3. Amputation (for unspecified Dis.)																																												
XI. MALFORMATIONS, ETC.																																												
1. Still Births		9	4		13			13																																				13
2. Congen. Debil. & Malformations.		22	13		35			35																																				35
3. Other Diseases of Infancy																																												
4. Senile Decay		12	6		6	11	1		14	4																																	18	
XII. SUICIDE. Total		43	23		54	11	1		48	14	4	48																															66	
1. Poison																																												
2. Strangulation																																												
3. Gas Poisoning																																												
4. Drowning																																												
5. Firearms																																												
XIII. ACCIDENTS. Total																																												
1. Fractures and Dislocations		3	1		3	1		1	2	1																																	4	
2. Gunshot		2			2			2																																			2	
3. Lightning																																												
4. Drowning		5			5			2	3																																		5	
5. Electric Cars																																												
6. Bicycles																																												
7. Railways		1			1			1																																			1	
8. Burns and Scalds		2	3		5			5																																			5	
9. Homicide																																												
10. Accidental Poisoning																																												
XIV. ILL-DEFINED CAUSES. Total		13	4		16	1		9	2	6		2	1	1	3		1	1	2	2																							17	
1. Dropsy		3	1		4			2		2																																	4	
2. Tumors					1			1																																			1	
3. Other Ill-Defined Causes		3	5		7	1		5	3						3		1	1		1																						8		
Total		6	7		7	6	1		5	6	2				3		3	1	2		2																					13		
Total from all causes		138	112		194	38	18		144	60	46	76	15	9	4	1	11	7	7	13	12	11	6	2	9	8	17	22	13	7	19	16	18	24	19	14	17	24	25	19	31	24	250	

CAUSES OF DEATHS BY COUNTIES IN 1898.—DUFFERIN.—POPULATION, 23,868, (Including Municipalities of all classes.)

General Diseases.	Sex.		Nativity.		Sec. con.		Ages.										Months.												Totals.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
	Male.	Female.	Canada.	Foreign.	Not sta.	Single.	Married.	Under 5.										80 & ov.	70-79.	60-69.	50-59.	45-49.	35-39.	30-34.	25-29.	20-24.	15-19.	10-14.		5-9.	0-1.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	Dec.	Nov.	Oct.	Sept.	Aug.	July.	June.	May.	April.	March.	Feb.	Jan.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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CAUSES OF DEATHS BY COUNTIES IN 1898.—ELGIN.—POPULATION, 46,547. (Including Municipalities of all classes.)

General Diseases.	Sex.	Nativity.		Soc. con.		Ages.					Months.												Totals.							
		Male.	Female	Canada.	Foreign.	Not sta.	Single.	Married.	Not sta.	Under 5.					Jan.	Feb.	March.	April.	May.	June.	July.	Aug.		Sept.	Oct.	Nov.	Dec.			
										0	1	2	3	4														5-9.	10-14.	15-19.
Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	41
I. COMMUNICABLE DISEASES																														
1. Typhoid Fever	4	1			5			2	3									1	2	1									5	
2. Smallpox																													2	
3. Measles	2				1			2			1																		7	
4. Scarlet Fever	3	4			7			7			1	1	1	3															2	
5. Whooping Cough	2				2			2			1																		1	
6. Diphtheria and Croup	10	5			15			15			2	2	1	2	5	1													15	
7. Influenza	4	2			2	4		2	4																				6	
8. Other Epidemic Diseases																													1	
Total	23	14			32	5		28	2	7	1	3	4	2	3	9	1		2	2	1								37	
II. OTHER GENERAL DIS'S.																														
1. Pyæmia and Septicæmia	4	6			5	5		2	5	3																			10	
2. Malarial Fever	26	32			48	10		24	14	20																			58	
3. Tuberculous and Scrofula																													13	
4. Syphilis	7	6			6	7		6	7																				4	
5. Cancer	2	2			2	2		1	3																				4	
6. Rheumatism and Gout	4				3	1		4																					4	
7. Diabetes																														
8. Other General Diseases																														
9. Alcoholism, Acute and Chronic.																														
Total	43	46			64	25		26	26	37																			89	
Local Diseases.																														
III. NERVOUS SYSTEM.																														
1. Encephalitis	6	3			9			8	1																				9	
2. Simple Meningitis	2				2			1	1																				2	
3. Epidic Cerebro-spinal Meningitis	2				2			2																					2	
4. Congestion and Hemor'ge of Brain	3	5			3	5		2	3	3																			8	
5. Stiffening of the Brain	1				1			1																					1	
6. Paralysis without specified cause.	16	10			12	13	1	1	11	14																			26	
7. Insanity																														
8. Epilepsy																														
9. Convulsions (not puerperal)	5	6			10	1		9	1																				11	
10. Other Nervous Diseases		3			2	1		2	1																				3	
Total	31	28			41	20	1	26	16	20																			62	
IV. CIRCULATORY SYSTEM.																														
1. Pericarditis																														
2. Endocarditis	1				1			1																					1	

CAUSES OF DEATHS BY COUNTIES IN 1898.—ESSEX.—POPULATION, 59,607. (Including Municipalities of all classes).

General Diseases.	Sex.	Nativity	Soc. con.		Ages.												Totals.											
			Canada.	Foreign.	Under 5.					Months.																		
					Not sta.	Single.	Married.	Not sta.	5-9.	10-14.	15-19.	20-24.	25-29.	30-34.	35-39.	40-44.		45-49.	50-59.	60-69.	70-79.	80 & ov.	Not revn.					
Male.	Female.	Not sta.	Canada.	Foreign.	Not sta.	Single.	Married.	Not sta.	0	1	2	3	4	5-9.	10-14.	15-19.	20-24.	25-29.	30-34.	35-39.	40-44.	45-49.	50-59.	60-69.	70-79.	80 & ov.	Not revn.	
Number of Column.																												
I. COMMUNICABLE DISEASES.																												
1. Typhoid Fever.....	6 2		7	1	5 2 1				1	1	1	1	1	2		3	1	1	1	2							1	8
2. Smallpox.....	1 2		3		3				1	1																		3
3. Measles.....	1 2		5		5				3	2																		5
4. Scarlet Fever.....	2 3		38		37 1 4				6	9	5	7	1														38	
5. Whooping Cough.....	18 20		7 4		4 3 4				4																		11	
6. Diphtheria and Croup.....	8 3		1		1																						1	
7. Influenza.....	1																											1
8. Other Epidemic Diseases.....																												1
Total.....	35 31		61 4 1	55 6 5					7	10	10	5	7	1 4	2 1	2 2	1 1 3											66
II. OTHER GENERAL DISS.																												
1. Pyæmia and Septicæmia.....	4 4		6 2		7 1																							8
2. Malarial Fever.....	26 49		58 17		31 29 15				6	2	1	1	2	4 5 14	6 7	1 6	8 7 4											75
3. Tuberculosis and Sc'ofula.....	9 9		8 9 1		11 7																							18
4. Syphilis.....	1 1		4 1		2 3																							1
5. Cancer.....	2 3		2		1 1																							5
6. Rheumatism and Gout.....	2 2		2		1 1																							2
7. Diabetes.....																												2
8. Other General Diseases.....																												2
9. Alcoholism, Acute and Chronic.....																												2
Total.....	45 66		81 28 2	35 51 25					7	2	1	1	1	2 4 7 17	7 10	1 10	12 11 5 3											111
Local Diseases.																												
III. NERVOUS SYSTEM.																												
1. Encephalitis.....	2		2		2				2	2	1		2	1														2
2. Simple Meningitis.....	4 5		9 1		9				4	3	1		1															9
3. Epidic Cerebro-spinal Meningitis.....	4 6		8 8		4 5 9																							10
4. Congestion and Hemor'gs of Brain.....	11 7		8 2		4 5 9																							18
5. Softening of Brain.....																												18
6. Paralysis without specified cause.....	6 12		8 9 1		2 12 4																							2
7. Insanity.....	1 1		2		2																							8
8. Epilepsy.....																												8
9. Convulsions (not puerperal).....	4 4		8		8																							8
10. Other Nervous Diseases.....																												8
Total.....	30 37		46 18 3	36 17 14					11	6	4	1	3	1 1	1 1	2 3	1 9 7 9 5											67
IV. CIRCULATORY SYSTEM.																												
1. Pericarditis.....																												3
2. Endocarditis.....	3		2		3																							3

[illegible]

3. Organic Heart Diseases	1924	1380	22516	...	...	2	...	1	2	1	2	1	2	15	12	6	...	1	4	3	8	3	2	5	2	5	5	1	43
4. Angina Pectoris .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5. Arteries, Atheroma, Aneurism, etc	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9. Other Dis. of Circulatory System.	7	8	2	9	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	27	33	4	35	21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V. RESPIRATION.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1. Acute Bronchitis	6	6	11	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2. Chronic Bronchitis	1	4	...	4	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3. Broncho-pneumonia	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4. Pneumonia	24	8	23	9	14	8	10	4	3	1	2	1	1	1	2	1	4	4	2	...	...	...	...	...	...	...	...	...	...
6. Pleurisy .....	...	...	3	...	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5. Congestion of the Lungs	6	2	3	5	4	1	3	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7. Asthma and Emphysema	2	...	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8. Other Dis. of the Respir System.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	40	24	42	22	32	16	16	10	8	3	2	2	1	1	1	3	2	3	6	10	7	4	...	...	...	...	...	...	...
VI. DIGESTIVE SYSTEM.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1. Ulcer of the Stomach	2	...	2	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2. Other Dis. of Stom. (cancer except'd)	5	6	2	9	1	5	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3. Infan. Diarr. & Cholera Infantum	16	14	30	...	30	...	...	25	4	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4. Diarr. & Enteritis (not infantile).	7	10	11	6	8	5	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5. Dysentery	1	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6. Hernia and Intestinal obstructions	5	...	...	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7. Other Diseases of the Intestines...	1	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8. Diseases of the Liver	9	4	6	7	2	3	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9. Peritonitis (not puerperal)	3	5	6	2	1	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10. Iliac abscess and appendicitis.	5	...	5	...	2	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	53	40	63	30	44	22	27	25	4	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
VII. GENITO-URINARY SYSTM.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1. Acute Nephritis .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2. Bright's Disease	7	5	10	2	...	2	6	4	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3. Other Dis. of Kidneys & Adnxa.	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4. Vesical Calculi .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5. Diseases of the Bladder	5	...	1	4	...	3	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6. Dis. of the male Genital Organs	1	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7. Metritis .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8. Other Diseases of the Uterus .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9. Ovarian Cysts & Ovarian Tumors.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10. Other Dis. of fem. Genital Organs	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	13	7	13	7	3	10	7	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
VIII. PUERPERAL DISEASES.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1. Puerperal Septicæmia .....	...	2	2	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2. Puer'l Albuminuria and Convul.	...	1	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3. Other acc. of Preg., sudden death	...	7	6	...	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4. Puerperal Disease of the Breast.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total .....	...	1C	8	2	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

GREY.—Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
IX. THE SKIN.																																										
1. Erysipelas																																										
2. Skin and Adnexa (Cancer except'd)																																										
X. LOCOMOTOR SYSTM. Total																																										
1. Pott's Disease																																										
2. Diseases of Bones and Joints																																										
3. Amputation (for unspecified Dis.)																																										
Total.....																																										
XI. MALFORMATIONS, ETC.																																										
1. Still Births																																										
2. Congen. Debil. and Malformations																																										
3. Other Diseases of Infancy																																										
4. Senile Decay																																										
Total.....																																										
XII. SUICIDE. Total																																										
1. Poison																																										
2. Strangulation																																										
3. Gas Poisoning																																										
4. Drowning																																										
5. Firearms																																										
Total.....																																										
XIII. ACCIDENTS. Total																																										
1. Fracture and Dislocations																																										
2. Gunshot																																										
3. Lightning																																										
4. Drowning																																										
5. Electric Cars																																										
6. Bicycles																																										
7. Railways																																										
8. Burns and Scalds																																										
9. Homicide																																										
10. Accidental Poisoning																																										
Total.....																																										
XIV. ILL-DEFINED CAUSES.																																										
1. Dropsy																																										
2. Tumors																																										
3. Other Ill-Defined Causes																																										
Total.....																																										
Total from all causes																																										

HALTON.—Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41			
IV.—Continued.																																													
3.	Organic Heart Disease	8	6		7	7		2	8	4																																			
4.	Angina Pectoris																																												
5.	Arteries, Atheroma, Aneurism, etc	2	3		2	3		1	2	2								1	1																										
6.	Other Dis. of Circulatory System.	10	9		9	10		3	10	6								1	1																										
V. RESPIRATION.																																													
1.	Acute Bronchitis		2		2			2			2																																		
2.	Chronic Bronchitis	1			2			1																																					
3.	Broncho-pneumonia	12	3		11	4		5	3	7				1	1			2																											
4.	Pneumonia																																												
5.	Pleurisy																																												
6.	Congestion of the Lungs	1			1			1																																					
7.	Asthma and Emphysema																																												
8.	Other Dis. of Respiratory System																																												
Total		16	5		16	4	1	9	4	8		2	2	2	1		2																												
VI. DIGESTIVE SYSTEM.																																													
1.	Ulcer of the Stomach																																												
2.	Other Dis. of Stom. (cancer exp'd)							1																																					
3.	Infan. Diar. & Cholera Infantum.	6	2		8			8			6	2																																	
4.	Diarr. & Enteritis (not infantile).	1	1		2			2										1																											
5.	Dysentery								1																																				
6.	Hernia and Intestinal obstructions																																												
7.	Other Diseases of the Intestine.																																												
8.	Diseases of the Liver	2	4		5	1		6																																					
9.	Peritonitis (not puerperal)					1		1																																					
10.	Iliac abscess and appendicitis																																												
Total		9	10		16	8		11	8		6	2					1																												
VII. GENITO-URINARY SYSTM.																																													
1.	Acute Nephritis																																												
2.	Bright's Disease	2	1		1	2		2	1																																				
3.	Other Dis. of Kidneys & Adnexa.																																												
4.	Vesical Calculi																																												
5.	Diseases of the Bladder	2				2		2																																					
6.	Dis. of the male Genital Organs.																																												
7.	Metritis																																												
8.	Other Diseases of the Uterus																																												
9.	Ovarian Cysts & Ovarian Tumors.																																												
10.	Other Dis. of fem. Genital Organs																																												
Total		4	1		1	4		2	3																																				
VIII PUERPERAL DISEASES.																																													
1.	Puerperal Septicæmia																																												

lviii.

CAUSES OF DEATHS BY COUNTIES IN 1898.—HASTINGS.—POPULATION, 63,508. (Including municipalities of all classes.)

General Diseases.		Number of Column.	Sex.		Canada.	Natv'ty.	Soc'l con.		Age.					Months.												Totals.									
			Male.	Female.			Foreign.	Not sta.	Single.	Married.	Not sta.	Under 5.					10-14.	15-19.	20-24.	25-29.	30-34.	35-39.	40-44.	45-49.	50-59.		60-69.	70-79.	80 & ov.	Nov.	Dec.				
												0-1	1-2	2-3	3-4	5-9																			
I. COMMUNICABLE DISEASES.																																			
1.	Typhoid Fever.....	9	3	11	1	1	7	2	3	1	1	2	2	1	2	1	1	1	1	1	2	1	1	1	2	1	1	1	1	1	1	1	12		
2.	Smallpox.....	2	2	4	3	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4		
3.	Measles.....	2	1	3	3	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3		
4.	Scarlet Fever.....	1	1	2	2	2	2	2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2		
5.	Whooping Cough.....	16	10	26	26	4	26	4	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	26		
6.	Diphtheria and Croup.....	2	4	6	6	4	2	2	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6			
7.	Influenza.....	32	21	52	1	1	45	3	5	4	3	5	6	4	2	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	53		
8.	Other Epidemic Diseases.....	1	9	8	2	1	5	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10		
II. OTHER GENERAL DISES.																																			
1.	Pyæmia and Septicæmia.....	34	44	69	8	1	28	31	19	2	2	8	15	9	3	8	5	6	3	1	1	1	1	1	1	1	1	1	1	1	1	1	78		
2.	Tuberculosis and Scrofula.....	8	6	8	6	4	4	6	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14		
3.	Syphilis.....	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2		
4.	Cancer.....	3	1	3	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4		
5.	Rheumatism and Gout.....	1	1	2	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2		
6.	Diabetes.....	1	1	2	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2		
7.	Other General Diseases.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2		
8.	Alcoholism, Acute and Chronic.....	50	62	93	18	1	41	43	28	2	4	10	16	10	5	9	7	12	11	8	2	1	1	1	1	1	1	1	1	1	1	1	1	112	
Total.																																			
Local Diseases.																																			
III. NERVOUS SYSTEM.																																			
1.	Encephalitis.....	5	3	8	6	1	1	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8		
2.	Simple Meningitis.....	2	4	6	6	1	1	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6		
3.	Epid'ic. Cerebro-spinal Meningitis.....	3	3	6	6	1	1	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	12		
4.	Congestion & Hemor'ge of Brain.....	7	5	7	5	2	5	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16		
5.	Softening of the Brain.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
6.	Paralysis without specified cause.....	13	19	21	11	2	18	12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	32		
7.	Insanity.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
8.	Epilepsy.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
9.	Convulsions (not puerperal).....	7	4	11	11	1	11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
10.	Other nervous Diseases.....	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2		
Total.																																			
IV. CIRCULATORY SYSTEM.																																			
1.	Pericarditis.....	42	38	63	17	34	25	21	2	5	3	2	3	1	1	4	8	10	16	6	1	1	1	1	1	1	1	1	1	1	1	1	80		
2.	Endocarditis.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		

HASTINGS.—Continued.

		Number of Column.																																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41						
IX. THE SKIN.																																																
1.	Erysipelas	2			1	1		1	1		1																																					
2.	Skin and Adnexa (cancer except'd)																																															
3.	Amputation (for unspecified Dis.)																																															
X. LOCOMOTOR SYST.M. Total		2			1	1		1	1		1																																					
1.	Pott's Disease	2	1		3			3																																								
2.	Diseases of Bones and Joints																																															
3.	Amputation (for unspecified Dis.)																																															
Total		2	1		3			3																																								
XI. MALFORMATIONS, ETC.																																																
1.	Still-Births	4	1		5			5																																								
2.	Congen. Debil. & Malformations	25	18		43			43																																								
3.	Other Diseases of Infancy	1	1		2			2																																								
4.	Senile Decay.....	44	40		35	47	2	3	45	36																																						
Total		74	60		85	47	2	53	45	36																																						
XII. SUICIDE.																																																
1.	Poison.....																																															
2.	Strangulation																																															
3.	Gas Poisoning	2	1		2	1		2	1																																							
4.	Drowning	2			1	1		1	1																																							
5.	Firearms																																															
Total		4	1		3	2		1	2																																							
XIII. ACCIDENTS.																																																
1.	Poison	3			3			3																																								
2.	Fractures and Dislocations	6	1		3	4		3	2																																							
3.	Gunshot																																															
4.	Lightning	1			1			1																																								
5.	Drowning	6	2		8			5	1	2																																						
6.	Electric Cars																																															
7.	Bicycles																																															
8.	Railways	11	4		8	1	6	3	3	9																																						
9.	Burns and Scalds	1	1		2			2																																								
10.	Homicide																																															
11.	Smothered	2	1		3			3																																								
Total		29	10		28	5	6	20	6	13																																						
XIV. ILL-DEF. CAUSES.																																																
1.	Dropsy	2	8		4	5	1	1	6	3																																						
2.	Tumors	1	4		3	2		2	2	1																																						
3.	Other Ill-Defined Causes	5	4		6	2		1	3	3																																						
Total		8	16		13	9	2	6	11	7																																						
Total from all causes....		364			529		147	304	213	172	121	21	8	10	11	25	23	29	32	28	15	26	28	46	60	104	74	6	59	50	70	57	61	42	51	65	56	55	66	57					689			

CAUSES OF DEATHS BY COUNTIES IN 1898.—KENT.—POPULATION, 62,991.—(Including Municipalities of all classes.)

General Diseases.		Number of Column.	Sex.		Nat'vty.		Soc. con.		Ages.					Months.												Totals.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
			Male.	Female.	Canada.		Foreign.	Not sta.	Single.	Married.	Not sta.	Under 5.					80 & ov.	Nov.	Dec.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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I. COMMUNICABLE DISEASES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

KENT.—Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IX. THE SKIN.																																												
1. Erysipelas																																												
2. Skin and Adnexa (Cancer except'd)																																												
X. LOCOMOTOR SYST'M. Total																																												
1. Pott's Disease																																												
2. Diseases of Bones and Joints																																												
3. Amputation (for unspecified Dis.)																																												
Total																																												
XI. MALFORMATIONS, ETC.																																												
1. Still-Births		9	14	2	25			25			25																																	
2. Congen. Debil. and Malformations		32	12		44			44			44																																	
3. Other Diseases of Infancy		2			2			2			2																																	
4. Senile Decay		36	36		24	42	6	2	23	41																																		
Total		77	64	2	95	42	6	73	29	41	69	1	1																															
XII. SUICIDE. Total																																												
1. Poison																																												
2. Strangulation																																												
3. Gas Poisoning																																												
4. Drowning		2			1	1		2																																				
5. Firearms					1	1																																						
Total		2			1	1		2																																				
XIII. ACCIDENT. Total		12	2		11	2	1	3	2	9																																		
1. Fractures and Dislocations																																												
2. Gunshot																																												
3. Lightning																																												
4. Drowning		7	1		6	1	1	4		4																																		
5. Electric Cars																																												
6. Bicycles		6	1		6	1		6	1																																			
7. Railways		2	4		6			4	1	1																																		
8. Burns and Sea'ds																																												
9. Homicide																																												
10. Accidental Poisoning																																												
Total		27	8		29	4	2	17	3	15																																		
XIV. ILL-DEFINED CAUSES. Total																																												
1. Dropsy		2	4		4	2		1	2	3																																		
2. Tumors		4	7		8	3		3	5	3																																		
3. Other Ill-Defined Causes		4	4		5	2	1	3	1	4																																		
Total		10	15		17	7	1	7	8	10																																		
Total from all causes		368	361	2	517	189	25	319	184	228	157	29	13	16	8	20	18	29	30	32	17	33	19	24	43	71	92	76	4	58	69	51	52	53	48	70	52	79	80	54	65	131		

CAUSES OF DEATHS BY COUNTIES IN 1898.—LENNOX AND ADDINGTON.—POPULATION 26,557. (Including Municipalities of all classes.)

General Diseases.	Number of Column.	Sex.		Nativity.		Soc. con.		Age.					Months.												Totals.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
		Male.	Female.	Canada.	Foreign.	Not sta.	Single.	Married.	Under 5.					Nov & Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sep.	Oct.		Nov.	Dec.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
									0-1.	1-2.	2-3.	3-4.	4-5.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
I. COMMUNICABLE DISEASES.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
1.	Typhoid Fever.....	5		5			1	4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										

LENNOX AND ADDINGTON.—Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41							
IX. THE SKIN.																																																	
1. Erysipelas		1			1			1																																									
2. Skin and Adnexa (Cancer excp'd)																																																	
X. LOCOMOTOR SYSTEM. Total		1			1			1																																									
1. Pott's Disease ..																																																	
2. Diseases of Bones and Joints																																																	
3. Amputation (for unspecified Dis.)																																																	
XI. MALFORMATIONS, ETC.																																																	
1. Still Births																																																	
2. Congen. Debil. and Malformations		12	16	28				28			28																																						
3. Other Diseases of Infancy		26	14	22	18			5	14	21																																							
4. Senile Decay																																																	
XII. SUICIDE. Total		38	30	50	18			33	14	21	28																																						
1. Poison		1			1			1																																									
2. Strangulation		1			1			1																																									
3. Gas Poisoning																																																	
4. Drowning																																																	
5. Firearms																																																	
XIII. ACCIDENT. Total		1	1		1	1				1																																							
1. Fractures and Dislocations		4			4			1		3																																							
2. Gunshot																																																	
3. Lightning																																																	
4. Drowning		2			2			2																																									
5. Electric Cars																																																	
6. Bicycles																																																	
7. Railways																																																	

LINCOLN.—Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IV. -Continued.																																												
3.	Organic Heart Diseases	10	20		17	13		1	18	11											1	1			3	4	8	9	3		2	1	1	3	5	4	2	1	1	2	5	3	30	
4.	Angina Pectoris	1				1																																					1	
5.	Arteries, Atheroma, Aneurism, etc	5	6		8	3		1	6	4											1	1			1	5	3																	
6.	Other Dis. of Circulatory System.																																											
Total		18	26		27	17		4	24	16											1	1			4	10	11	9	3		2	4	1	5	6	4	4	1	3	2	7	5	44	
V. RESPIRATION.																																												
1.	Acute Bronchitis	7	2		9			8		1																																	9	
2.	Chronic Bronchitis	4	5		4	5			6	3																																	9	
3.	Broncho-pneumonia	2	5		4	3		2	4	1																																7		
4.	Pneumonia	14	18		23	9		13	9	10																																	32	
5.	Pleurisy	1				1				1																																	1	
6.	Congestion of the Lungs	3	2					2	2	1																																5		
7.	Asthma and Emphysema																																											
8.	Other Dis. of Respiratory System																																											
Total		31	32		44	19		25	21	17																																	63	
VI. DIGESTIVE SYSTEM.																																												
1.	Ulcer of the Stomach	1								1																																	1	
2.	Other Dis. of Stom. (cancer exclud)	3	2		4	1		1	2	2																																5		
3.	Infan. Diarrh. & Cholera Infant'm	3	12		15			15																																			15	
4.	Diarrh. & Enteritis (not infantile)	4	5		8	1		7	2																																	9		
5.	Dysentery																																										4	
6.	Hernia & Intestinal obstructions.	2	2		3	1		3	1																																	1		
7.	Other Diseases of the Intestines.	1			1					1																																	3	
8.	Diseases of the Liver	1	2		2	1				1																																	3	
9.	Peritonitis (not puerperal)	1	4		2	3			3	2																																5		
10.	Ilac Abscess and Appendicitis...	1			1			1																																			1	
Total		17	27		36	8		24	12	8																																	44	
VII. GENITO-URINARY SYST.M.																																												
1.	Acute Nephritis																																											
2.	Bright's Disease	4	2		3	3			1	5																																	6	
3.	Other Dis. of Kidneys & Adnexa.																																											
4.	Vesical Calculi																																											
5.	Diseases of the Bladder	6			4	2																																					6	
6.	Dis. of the male Genital Organs.																																											
7.	Metritis																																											
8.	Other Diseases of the Uterus																																											
9.	Ovarian Cysts & Ovarian Tumors																																											
10.	Other Dis. of fem. Genital Organs																																											
Total		10	2		7	5			2	10																																	12	
VIII. PUERPERAL DISEASES.																																												
1.	Puerpera. Septicaemia																																											
Total																																												

XXXXII.

CAUSES OF DEATHS BY COUNTIES IN 1898.—MUSKOKA.—POPULATION, 17,782. (Including Municipalities of all classes.)

General Diseases.	Number of Column.	Sex.		Natvty.		Soc'l con.		Ages.										Months.												Totals.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		Male.	Female.	Canada.	Foreign.	Not sta.	Single.	Married.	Not sta.	Under 5.					80 & ov.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
										0-1	1-2	2-3	3-4	4-5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
I. COMMUNICABLE DISEASES.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
1. Typhoid Fever		1	2	3	4	5	6	7	8	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		</

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41				
IX. THE SKIN.																																														
1.	Erysipelas	3			1	2				3																																				
2.	Skin and Adenæ (Cancer except'd)																																													
X. LOCOMOTOR SYST'M. Total		3			1	2				3																																				
1.	Pott's Disease																																													
2.	Diseases of Bones and Joints																																													
3.	Amputation (for unspecified Dis.)																																													
XI. MALFORMATIONS. ETC. Total																																														
1.	Still-Births	1	3		4			4			4																																			
2.	Congen. Debil. & Malformations.	8	10		18			18			18																																			
3.	Other Diseases of Infancy	1			1			1																																						
4.	Senile Decay	17	17		17	14	3	2	17	15																																				
XII. SUICIDE. Total		27	30		40	14	3	25	17	15																																				
1.	Poison																																													
2.	Strangulation																																													
3.	Gas Poisoning																																													
4.	Drowning	1			1			1																																						
5.	Firearms	1			1			1																																						
6.	Suicide by Cutting Throat	1			1			1																																						
XIII. ACCIDENT. Total		2			2			2			2																																			
1.	Fractures and Dislocations	4	2		4	1	1	2	2	2																																				
2.	Gunshot																																													
3.	Lightning																																													
4.	Drowning	2			1	1		2																																						
5.	Electric Cars																																													
6.	Bicycles																																													
7.	Railways	1	1		2			2																																						
8.	Burns and Scalds																																													
9.	Homicide																																													
10.	Accidental Poisoning																																													
Total.		7	3		7	1	2	6	2	2																																				
XIV. ILL-DEFINED CAUSES.																																														

CAUSES OF DEATHS BY COUNTIES IN 1898.—NIPissing.—POPULATION, 12,636. (Including Municipalities of all classes.)

General Diseases.	Number of Column.	Sex.		Nativity.		Sec. con.		Under 5.					Ages.										Months.												Totals.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		Male.	Female.	Canada.	Foreign.	Not sta.	Single.	Married.	Not sta.	Under 5.					Ages.										Months.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
										0-1.	1-2.	2-3.	3-4.	5-9.	10-14.	15-19.	20-24.	25-29.	30-34.	35-39.	40-44.	45-49.	50-59.	60-69.	70-79.	80 & ov.	Not'yn	Jan.	Feb.	March.	April.	May.	June.	July.		Aug.	Sept.	Oct.	Nov.	Dec.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
I. COMMUNICABLE DISEASES.		1	2	3	4	5	6	7	8	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			</

PARRY SOUND,--Continued.

[illegible]

CAUSES OF DEATHS BY COUNTIES IN 1898.—PEEL.—POPULATION, 26,687. (Including Municipalities of all classes.)

General Diseases.	Number of Column.	Sex.		Natv'ty.		Soc'l con.		Ages.										Month.												Totals.			
		Male.	Female.	Canada.	Foreign.	Single.	Married.	Under 5.					80 & ov.					Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.				
								0-1.	1-2.	2-3.	3-4.	5-9.	10-14.	15-19.	20-24.	25-29.	30-34.														35-39.	40-44.	45-49.	50-59.	60-69.	70-79.	80 & ov.
		1	2	3	4	5	6	7	8	9																							41
		1	1		1	1		1																									2
								2																									2
								2																									2
		1	1		1	1		1																									2
																																	2
								6	2																								8
Total		2	6		6	2		1	3																								68
II. OTHER GENERAL DISES.		3	3		4	1	1	3	2																								6
1. Pyæmia and Septicæmia		1	1		2		2																										2
2. Malarial Fever		12	23		29	6	15	13	7																								35
3. Tuberculosis and Scrofula																																	19
4. Syphilis		4	15		7	9	3	12	4																								1
5. Cancer					1			1																									1
6. Rheumatism and Gout		2			2			2																									1
7. Diabetes		1	2		3		1	2																									3
8. Other General Dis-eases																																	
9. Alcoholism, Acute and Chronic																																	
Total		23	45		48	16	4	22	31	15																							
Local Diseases.																																	
III. NERVOUS SYSTEM.		1			1			1																									1
1. Encephalitis																																	1
2. Simple Meningitis		7	1		5	3	2	1	5																								8
3. Epidic Cerebro-spinal Meningitis																																	6
4. Congestion and Hemor'ge of Brain		3	3		3	3	1	2	3																								1
5. Softening of the Brain																																	1
6. Paralysis without specified cause		1																															1
7. Insanity																																	6
8. Epilepsy		4	2		6		6																										1
9. Convulsions (not puerperal)																																	1
10. Other Nervous Diseases																																	1
Total		16	7		16	6	1	11	4	8																							23
IV. CIRCULATORY SYSTEM.																																	1
1. Pericarditis																																	
2. Endocarditis																																	

CAUSES OF DEATHS BY COUNTIES, IN 1898.—PERTH.—POPULATION, 55,498. (Including municipalities of all classes.)

General Diseases.		Sex.		Natv'ty.		Soc'l con.		Ages.					Months.												Totals.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		Male.		Female.		Canada.		Foreign.		Not sta.		Single.		Married.		Not sta.		Under 5.					Ages.							Months.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
I. COMMUNICABLE DISEASES.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												</	

CAUSES OF DEATHS BY COUNTIES IN 1898. - PETERBORO' - POPULATION, 37,889. (Including Municipalities of all classes.)

General Diseases.	Sex.	Natvty.	Soc'l. con.	Ages.					Months.												Totals.		
				Under 5.					Nov & Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.		Dec.	
				0-1.	1-2.	2-3.	3-4.	5-9.															
I. COMMUNICABLE DISEASES.																							
1. Typhoid Fever	4	7	8	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	11
2. Smallpox	3	1	4	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
3. Measles	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
4. Scarlet Fever	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5. Whooping Cough	3	3	6	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6. Diphtheria and Croup	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
7. Influenza	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6
8. Other Epidemic Diseases	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
Total	15	13	24	7	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	23
II. OTHER GENERAL DISEASES.																							
1. Pyæmia and Septicæmia	6	2	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6
2. Malarial Fever	2	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
3. Tuberculosis and Scrofula	34	35	56	4	3	3	1	2	7	10	5	6	4	5	1	5	3	1	1	1	1	1	69
4. Syphilis	8	10	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
5. Cancer	3	3	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6
6. Rheumatism and Gout	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4
7. Diabetes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8. Other General Diseases	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
9. Alcoholism, Acute and Chronic	51	58	81	27	1	1	4	3	3	1	1	3	9	11	12	6	6	5	9	14	13	12	109
Total	151	158	227	74	53	53	21	21	59	99	126	138	86	86	99	126	138	138	138	138	138	138	138
III. LOCAL DISEASES.																							
IV. NERVOUS SYSTEM.																							
1. Encephalitis	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2. Simple Meningitis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
3. Epidemic Cerebro-spinal Meningitis	8	10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	18
4. Congestion and Hemorrhage of Brain	6	4	3	7	1	5	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10
5. Softening of Brain	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6. Paralysis without specified cause	12	4	16	12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	16
7. Insanity	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8. Epilepsy	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
9. Convulsions (not puerperal)	12	4	16	12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	16
10. Other Nervous Diseases	32	22	37	17	14	15	14	1	2	1	3	1	1	1	1	1	1	1	1	1	1	1	54
Total	11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
V. CIRCULATORY SYSTEM.																							
1. Pericarditis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2. Endocarditis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

PETERBORO' - Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41			
IX. THE SKIN.																																													
1. Erysipelas		2			1	1		1	1		1																																		2
2. Skin and Adnexa (Cancer except'd)																																													
X. LOCOMOTOR SYST'M. Total		2			1	1		1	1		1																																		2
1. Pott's Disease																																													
2. Diseases of Bones and Joints																																													
3. Amputation (for unspecified Dis.)																																													
XI. MALFORMATIONS, ETC.																																													
1. Still Births		16	8	1	25			25			25																																	25	
2. Congen Debil. and Malformations		20	12		32			32			32																																	32	
3. Other Diseases of Infancy		30	30		8	52		3	36	21																																		60	
4. Senile Decay																																													
XII. SUICIDE. Total		66	50	1	65	52		60	36	21	57																																		117
1. Poison																																													
2. Strangulation																																													
3. Gas Poisoning																																													
4. Drowning																																													
5. Firearms																																													
XIII. ACCIDENTS. Total																																													
1. Fracture and Disl- cations		5	1		3	2	1	2		4																																		6	
2. Gunshot		2	1		3			2	1																																			3	
3. Lightning																																													
4. Drowning		7			4	3		3	4																																			7	
5. Electric Cars		1			1			1																																				1	
6. Bicycles																																													
7. Railways		2	1		1	2		1	2																																			3	
8. Burns and Scald																																													
9. Homicide																																													
10. Accidental Pois- ning																																													
XIV. ILL-DEFINED CAUSES. Total		16	4		12	7	1	9	2	9																																		20	
1. Dropsy		3	5		3	5		1	4	3																																		8	
2. Tumors		3	1		4			3	1																																		4		
3. Other Ill-Defind Causes		3	2		4	1		4	1																																			5	
Total		9	8		11	6		8	5	4																																		17	
Total from all causes		261	219	1	326	152	3	225	124	132	108	10	14	3	5	16	11	15	19	20	13	20	12	17	20	62	61	52	3	43	34	42	46	38	30	47	49	37	36	33		481			

Number of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	
IV.—Continued.																																										
3. Organic Heart Disease	10	7		15	2		2	9	6						1	1			1	2		1	1	3	4	2	1										3		1	2	1	17
4. Angina Pectoris																																									1	
5. Arteries, Atheroma, Aneurism, etc	1	3	2	1			1	2	2										1			2	2													1		1	5			
6. Other Dis of Circulatory System.				5			1	2																																23		
Total.	14	9		21	2		3	12	8						1	1	1		1	1	2	1	3	5	5	2	1														9	
V. RESPIRATION.																																										
1. Acute Bronchitis	5	4		8	1		8	1	1		4		1	1	1	1																									1	
2. Chronic Bronchitis					1																																				1	
3. Broncho-pneumonia	13	20		29	3	1	21	5	7		6	3	1	2	1	4	1		4			1	3	3	2	1															33	
4. Pneumonia																																									6	
5. Pleurisy	2	4		6			5	1	1		1	1	1	1	1	1																								3		
6. Congestion of the Lungs	2	1		3																																				1		
7. Asthma and Emphysema				1					1																															3		
8. Other Dis of Respiratory System				1																																				1		
Total	23	30		47	5	1	34	8	11		11	4	2	3	3	5	1		4																					53		
VI DIGESTIVE SYSTEM.																																										
1. Ulcer of the Stomach		1		1					1																																1	
2. Other Dis. of Stom. (cancer exp'd)	1	2		2	1																																			3		
3. Infan. Diar. & Cholera Infantum.	31	27		57	1		58				51	7																												58		
4. Diarr. & Enteritis (not infantile)		5	8	11	2		6	2	3				1	3				2	1		1																		13			
5. Dysentery																																										
6. Hernia and Intestinal obstructions																																										
7. Other Diseases of the Intestine.	1	1		2					1									1																						1		
8. Diseases of the Liver	1	1		2																																				2		
9. Peritonitis (not puerperal)	3	1		4			3	1										1	1																				4			
10. Ilac abscess and appendicitis	1	1		1			1											1	1																				1			
Total	42	41		79	4		68	4	11		51	7	1		4	1		4	1	2	1	1																		83		
VII. GENITO-URINARY SYSTM.																																										
1. Acute Nephritis				1					1																																1	
2. Bright's Disease		2		2					2																															2		
3. Other Dis. of Kidneys & Adnexa.																																										

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	
IX. THE SKIN.																																											
1. Erysipelas																																											
2. Skin and Adnexa (cancer except'd)																																											
X. LOCOMOTOR SYST'M. Total																																											
1. Pott's Di-ease																																											
2. Diseases of Bones and Joints																																											
3. Amputation (for unspecified Dis.)																																											
XI. MALFORMATIONS, ETC.																																											
1. Still-Births		1			1			1																																			
2. Congen. Debil. & Malformations		7	3		10			10			10																																
3. Other Dis-eases of Infancy		11	22		25	8			17	16																																	
4. Senile Decay																																											
XII. SUICIDE. Total		19	25		36	8		11	17	16		11																															
1. Poison		1			1																																						
2. Strangulation		1																																									
3. Gas Poisoning																																											
4. Drowning																																											
5. Firearms																																											
XIII. ACCIDENTS. Total		1			1			1																																			
1. Poison		3			2	1			3																																		
2. Fractures and Dislocations		6	1		5	2		1	2	4																																	
3. Gunshot																																											
4. Lightning																																											
5. Drowning		6			4	1	1	4	2																																		
6. Electric Cars																																											
7. Bicycles																																											
8. Railways		2			1	1		1	1																																		
9. Burns and Scalds																																											

Number of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IV.—Continued.																																											
3. Organic Heart Diseases	3			1	2		1	1	1																																		
4. Angina Pectoris																																											
5. Arteries, Atheroma, Aneurism, etc.	2	1		1	1		2	1																																			
6. Other Dis. of Circulatory System.																																											
Total.....	2	4		2	1	3		3	2	1																																	
V. RESPIRATION.																																											
1. Acute Bronchitis.....	1	1		1	1		2																																				
2. Chronic Bronchitis																																											
3. Broncho-pneumonia	3	7		9	1		9	1																																			
4. Pneumonia	1																																										
5. Pleurisy	1																																										
6. Congestion of the Lungs.....	1			1			1																																				
7. Asthma and Emphysema.....																																											
8. Other Dis. of the Resp'y System.																																											
Total.....	6	10		13	1	2	14	2		7	2	1	2																														
VI. DIGESTIVE SYSTEM.																																											
1. Ulcer of the Stomach.....																																											
2. Other Dis. of Stom. (cancer except'd)																																											
3. Infan. Diarr. & Cholera Infantum	2	6		8			8																																				
4. Diarr. & Enteritis (not infantile).		1		1				1																																			
5. Dysentery																																											
6. Hernia and Intestinal obstructions																																											
7. Other Diseases of the Intestines																																											
8. Diseases of the Liver																																											
9. Peritonitis (not puerperal).....																																											
10. Iliaic abscess and appendicitis.....	1	1		2				2																																			
Total.....	3	8		11			8	1	2	8																																	
VII. GENITO-URINARY SYSTM.																																											
1. Acute Nephritis																																											
2. Bright's Disease	1	1		1	1			1	1																																		
3. Other Dis. of Kidneys & Adnexa.																																											
4. Vesical Calculi.....	1			1				1																																			
5. Diseases of the Bladder																																											
6. Dis. of the Male Genital Organs.																																											
7. Metritis																																											
8. Other diseases of the Uterus.....																																											
9. Ovarian Cysts & Ovarian Tumors																		</																									

CAUSES OF DEATHS BY COUNTIES IN 1898.—RENFREW.—POPULATION, 49,370. (Including Municipalities of all classes.)

General Diseases.		Sex.		Nativity.		Soc'l con.		Ages.					Months.												Totals.					
		Male.	Female.	Canada.	Foreign.	Single.	Married.	Not sta.	Under 5.					Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.		Dec.				
									0-1	1-2	3-4	5-9	10-14														15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59	60-69	70-79	80 & ov.
Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	41
I. COMMUNICABLE DISEASES.																														
1.	Typhoid Fever.....	6	3		8	1		5	4					1														1	2	9
2.	Smallpox.....										1	1																		4
3.	Measles.....	3	1	4			4																							3
4.	Scarlet Fever.....	3		3			3							1	1															1
5.	Whooping Cough.....	1		1			1																							1
6.	Diphtheria and Croup.....	12	5	17			17				1	6	3	2																17
7.	Influenza.....	3		1	2																									3
8.	Other Epidemic Diseases.....																													3
Total		28	9	34	2	1	30	4	3		2	2	6	3	4	4	1	1	1	1										37
II. OTHER GENERAL DIS'S.																														
1.	Pyæmia and Septicæmia.....	3	8		7	3	1	2	6	3																				11
2.	Malarial Fever.....																													
3.	Tuberculosis and Scrofula.....	13	35	44	4		20	13	15		1	1				1	1	5	7	9	3	3	3	2	1	1	1	1	2	48
4.	Syphilis.....																													
5.	Cancer.....	5	7	7	5		2	7	3																					12
6.	Rheumatism and Gout.....	1	1	1			1																							1
7.	Diabetes.....	1	1	1	1		1																							2
8.	Other General Diseases.....	1	1	2			1	1																						2
9.	Alcoholism, Acute and Chronic.....																													
Total		24	52	62	12	2	27	27	22		1	1	1																	76
III. NERVOUS SYSTEM.																														
Local Diseases.																														
1.	Encephalitis.....	2	4	6			4	1	1		3																			6
2.	Simple Meningitis.....	1	1	2							1	1																		2
3.	Epid'ic. Cerebro-spinal Meningitis.....	1	2	3																										2
4.	Congestion & Hemor'ge of Brain.....	4	2	2	4		2	1	3																					6
5.	Softening of the Brain.....																													
6.	Paralysis without t specified cause.....	3	3	3			1	3	2																					6
7.	Insanity.....																													
8.	Epilepsy.....	4	3	4	3		3	1	3					2																7
9.	Convulsions (not puerperal).....	5	6	11			11				6	3	1																	11
10.	Other Nervous Diseases.....	1		1			1																							1
Total		20	22	32	10		26	6	10		11	3	2	1																42
IV. CIRCULATORY SYSTEM.																														
1.	Pericarditis.....																													
2.	Endocarditis.....	1																												1

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IX. THE SKIN.																																												
1.	Erysipelas																																											
2.	Skin and Adnexa (cancer except'd)																																											
X. LOCOMOTOR SYST'M. Total.																																												
1.	Pott's Disease																																											
2.	Diseases of Bones and Joints																																											
3.	Amputation (for unspecified Dis.)																																											
XI. MALFORMATIONS, ETC. Total.																																												
1.	Still Births	6	9		15			15			15																																15	
2.	Congen. Debil. & Malformations	29	31	60				60			60																																	60
3.	Other Diseases of Infancy																																											
4.	Senile Decay	29	47		9	47		2	25	29																																	56	
XII. SUICIDE. Total.		64	67		84	47		77	25	29	76																																131	
1.	Poison						1																																					1
2.	Strangulation								1																																			
3.	Gas Poisoning																																											
4.	Drowning																																											
5.	Firearms																																											
XIII. ACCIDENTS. Total.							1			1																																		1
1.	Fractures and Dislocations	6			4	2		2	2	2																																	6	
2.	Gunshot											1																																
3.	Lightning																																											
4.	Drowning	10	1		10	1		5	6																																		11	
5.	Electric Cars																																											
6.	Bicycles																																											
7.	Railways	2			1	1			2																																		2	
8.	Burns and Scalds	1	2		3			3																																			3	
9.	Homicide																																											
10.	Accidental Poisoning	1	1		2			1																																			2	
XIV. ILL-DEFINED CAUSES. Total.		20	4		20	4		11	2	11																																	24	
1.	Dropsy	4	3		5	2		1	5	1																																	7	
2.	Tumors	2	2		3	1		1	2	1																																	4	
3.	Other Ill-Defined Causes	9	8		12	5		10	4	3																																	17	
Total		15	13		20	8		12	11	5																																	28	
Total from all causes		241	249		371	114	5	259	113	118	142	16	17	10	6	15	15	17	20	14	16	16	10	16	11	37	42	47	35	1	41	48	41	42	46	36	43	37	38	39	30	490		

SIMCOE.—Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IV.—Continued.																																												
3.	Organic Heart Disease.....	14	23		18	18	1	3	16	18					1				2	1	2						1	3	16	1	2	5	3	5	4	4	3	2	1	2	3	8	37	
4.	Angina Pectoris.....	1					1																																				1	
5.	Arteries, Atheroma, Aneurism, &c.....																																										14	
6.	Other Dis. of Circulatory System.....	5	9		9	4	1	1	8	5									2	1																						4		
Total		22	34		30	24	2	5	25	26									3	4																						56		
V. RESPIRATION.																																												
1.	Acute Bronchitis.....	12	17		24	5		24	4	1					1	2																											29	
2.	Chronic Bronchitis.....	4			1	4		5	1	4									1																								5	
3.	Broncho-pneumonia.....	2	5		6	2		5	1	1																																	7	
4.	Pneumonia.....	35	24		41	15	3	18	15	26					2	1			3	4	2	6																				59		
5.	Pleurisy.....	2	1		3			2	1										1	1																						3		
6.	Congestion of the Lungs.....	3			2	1				3																																3		
7.	Asthma and Emphysema.....	1	2			3				1	2																															3		
8.	Other Dis. of the Respir System.....																																											
Total		59	50		70	30	3	49	23	37																																	109	
VI. DIGESTIVE SYSTEM.																																												
1.	Ulcer of the Stomach.....		2		2			2	2	2																																	2	
2.	Other Dis. of Stom. (cancer except'd).....		5		4	2		4																																			6	
3.	Infan. Diarr. and Cholera Infant'm.....	25	16		41			41																																			41	
4.	Diarr'hæa & Enteritis (Lot infantile).....	13	6		14	5		11	4	4																																19		
5.	Dysentery.....	3	2		1	3	1		3	2																																5		
6.	Hernia & Intestinal obstructions.....	3	2		1	4				3	2																																3	
7.	Other Diseases of the Intestines.....		3		1	2		1	2																																		10	
8.	Diseases of the Liver.....	8	2		5	5		1	3	6																																8		
9.	Peritonitis (not puerperal).....	2	6		8			3	2	3																																5		
10.	Iliaic abscess and appendicitis.....	2	3		3	2		2	1	2																																		
Total		57	47		78	25	1	60	20	24																																	104	
VII. GENITO-URINARY SYSTEM.																																												
1.	Acute Nephritis.....		1		1																																						1	
2.	Bright's Disease.....	15	8		11	11	1	3	4	16																																	23	
3.	Other Dis. of Kidney & Adnexe.....																																											
4.	Vesical Calculi.....																																											
5.	Disease of the Bladder.....	5	1		4	2				1	5																																6	
6.	Dis. of the male Genital Organs.....																																										1	
7.	Metritis.....		1		1					1																																	1	
8.	Other diseases of the Uterus.....																																											
9.	Ovarian Cysts & Ovarian Tumors.....																																											
10.	Other Dis. of fem. Genital Organs.....																																											
Total		20	11		17	13	1	3	7	21																																	31	
VIII. PUERPERAL DISEASES																																												
1.	Puerperal Septicæmia.....		1		1																																						1	

CXXX.

STORMONT, DUNDAS AND GLENGARRY.—Continued.

Number of Column.																																								

3. Organic Heart Diseases	10	8	12	6	4	5	9	1	1	2	1	1	1	1	5	3	3	2	1	3	1	2	3	2	2	1	1	18
4. Angina Pectoris	2	5	6	1	1	4	2	1	1	2	1	1	1	1	2	2	1	1	1	2	1	1	1	1	1	1	7	
5. Arteries, Atheroma, Aneurism, etc	13	13	19	7	5	9	12	1	1	2	1	2	1	2	7	6	3	2	4	2	6	2	4	3	2	1	1	26
6. Other Dis. of Circulatory System	5	2	5	2	5	2	...	4	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	7	
V. RESPIRATION.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	
1. Acute Bronchitis	7	9	10	6	6	6	4	2	1	1	1	1	1	1	3	3	1	1	3	2	3	3	1	1	2	1	1	16
2. Chronic Bronchitis	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
3. Broncho-pneumonia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
4. Pneumonia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
5. Pleurisy	4	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
6. Congestion of the Lungs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
7. Asthma and Emphysema	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
8. Other Dis. of Respiratory System	19	14	18	15	12	10	11	6	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	33
VI. DIGESTIVE SYSTEM.	2	2	2	2	1	1	3	16	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
1. Ulcer of the Stomach	9	9	18	...	18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
2. Other Dis. of Stom. (cancer except)	4	2	5	1	4	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	
3. Infan. Diarr. & Cholera Infantum	2	2	2	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
4. Diarr. & Enteritis (not infantile)	6	6	2	4	5	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	6	
5. Dysentery	3	3	3	3	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	3	
6. Hernia & Intestinal obstructions	1	5	3	3	1	3	2	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	6	
7. Other Diseases of the Intestines	2	3	5	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	
8. Diseases of the Liver	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	
9. Peritonitis (not puerperal)	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	
10. Iliac abscess and appendicitis	20	30	37	13	27	13	10	16	2	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	50
VII. GENITO-URINARY SYST.M.	3	3	5	1	3	3	3	6
1. Acute Nephritis .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2. Bright's Disease .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3. Other Dis. of Kidneys & Adnexa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4. Vesical Calculi .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5. Diseases of the Bladder	2	...	1	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
6. Dis. of the male Genital Organs	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7. Metritis .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8. Other Diseases of the Uterus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9. Ovarian Cysts & Ovarian Tumors	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10. Other Dis. of fem. Genital Organs	5	3	6	2	1	3	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8
VIII. PUERPERAL DISEASES.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	1	1	...	1	1
1. Puerperal Septicæmia	3	3	...	3	3
2. Puerl. Albuminuria and Convul.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3. Other acc. of Preg., sudden death	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4. Puerperal Diseases of the Breast	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	4	4	...	4	4

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41			
IX. THE SKIN.																																													
1.	Erysipelas																																												
2.	Skin and Adnexa (Cancer except'd)																																												
X. LOCOMOTOR SYSTM. Total																																													
1.	Pott's Disease																																												
2.	Diseases of Bones and Joints																																												
3.	Amputation (for unspecified Dis.)																																												
XI. MALF'MATNS, ETC. Total																																													
1.	Still Births	9	15	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	
2.	Congen. Debil. & Malformations.	18	11	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
3.	Other Diseases of Infancy	27	16	5	36	2	2	16	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
4.	Senile Decay																																												
XII. SUICIDE. Total		54	42	58	36	2	55	16	25	25	53																																		
1.	Poison																																												
2.	Strangulation																																												
3.	Gas Poisoning																																												
4.	Drowning																																												
5.	Firearms																																												
XIII. ACCIDENTS. Total																																													
1.	Fractures and Dislocations	4	1	4	1	1	1	1	3	3																																			
2.	Gunshot																																												
3.	Lightning																																												
4.	Drowning	3		2	1	1	1	2																																					
5.	Electric Cars																																												
6.	Bicycles																																												
7.	Railways																																												
8.	Burns and Scalds																																												
9.	Homicide																																												
10.	Accidental Poisoning																																												
XIV. ILL-DEFINED CAUSES. Total		7	2	6	3	2	2	2	5	5																																			
1.	Dropsy	3	4	1	6	1	4	2																																					
2.	Tumors		2	2			1	1																																					
3.	Other Ill-Defined Causes	1	1	2			2																																						
4.	Lockjaw																																												
Total		4	7	5	6	3	5	3																																					
Total from all causes		195	190	278	105	2	97	183	105	105	100	11	8	6	5	7	4	19	13	16	17	15	8	12	25	31	44	41	3	28	32	40	31	33	35	26	34	28	40	29	29	385			

WATERLOO.—Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IV.—Continued.																																												
3.	Organic Heart Diseases	11	15		11	15		2	17	7						1					1	1		2	3	12	4	2			6		3	1	5	1	2	2	1	3	2		26	
4.	Angina Pectoris	2	1		2	1			1	2														1	1	1																	3	
5.	Arteries, Atheroma, Aneurism, etc																							1	1	1	3							3									7	
6.	Other Dis. of Circulatory System	5	2		4	3		4		3												1	1	1	1	3																		
	Total	18	21		19	20		3	24	12						1		1		1	2	2	4	5	17	4	2			6	1	6	1	7	2	3	2	2	3	5	1	39		
V. RESPIRATION. Total																																												
1.	Acute Bronchitis.....	7	8		8	7		4	7	4		4																				6	3		1	2	3					15		
2.	Chronic Bronchitis.....	3	3		1	5			4	2		1										1																				6		
3.	Broncho-pneumonia	4	2		4	2		2	3	1		1										1																				25		
4.	Pneumonia	9	16		16	9		8	10	7		3	2		1						1	2	1	1	2	6	5	1			4	2	3	4	2	3		1	1	2	1	3		
5.	Pleurisy	1	2		2	1		2	1																																	6		
6.	Congestion of the Lungs	5	1		3	2		3	1	2																																3		
7.	Asthma and Emphysema.....	1	2		3			2	1																																	3		
8.	Other Dis. of the Respir'y System																																											
	Total	30	34		34	29	1	19	23	17		8	3	2		1	1	1	3	2	1	1	6	14	15	5	1			10	7	8	11	5	8		2	2	4	4	3	64		
VI. DIGESTIVE SYSTEM.																																												
1.	Ulcer of the Stomach																																											
2.	Other Dis. of Stom. (cancer exp'd)	1																																									1	
3.	Infant. Diarr. & Cholera Infantum	10	14		23	1		24				23	1	1																													24	
4.	Diarr. & Enteritis (not infantile).	1	3		2	2		1	2	1																																4		
5.	Dysentery	1	1					2																																		2		
6.	Hernia and Intestinal obstructions	3	5		3	5		1	6	1																																8		
7.	Other Diseases of the Intestines	1	1		1			1																																		1		
8.	Diseases of the Liver.....	3	3		3			2	3	3																																6		
9.	Peritonitis (not puerperal)	2	3		3			2	1	2																																5		
10.	Iliac abscess and appendicitis	1	4		4	1		4	1																																	5		
	Total	23	33		36	19	1	33	15	8		24	1	2		2	5					2	1																				56	
VII. GENITO-URINARY SYSTM.																																												
1.	Acute Nephritis	1																																									1	
2.	Bright's Disease	11	5		6	10		2	6	8																																	16	
3.	Other Dis. of Kidneys & Adnexa.	1						1																																			1	
4.	Vesical Calculi																																											
5.	Diseases of the Bladder.....																																											
6.	Dis. of the male Genital Organs																																											
7.	Metritis	1			1				1																																		1	
8.	Other Diseases of the Uterus													</																														

3. Organic Heart Diseases	15	5	15	5	2	6	12	1	1	1	1	2	2	2	1	8	2	1	5	2	4	1	2	3	20		
4 Angina Pectoris	2	...	2	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2		
5. Arteries, Atheroma, Aneurism, etc	8	4	5	6	1	6	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12		
6. Other Dis. of Circulatory System.	25	9	22	11	1	2	13	19	1	1	1	1	2	3	2	5	4	4	6	2	4	3	4	1	...	34	
Total	6	4	4	6	...	3	5	2	1	1	1	...	...	...	...	1	1	3	2	1	3	1	2	...	...	10	
V. RESPIRATION.	2	1	2	1	...	2	1	3	1	1	1	...	...	...	...	1	1	1	2	1	2	1	...	...	3		
1. Acute Bronchitis	2	1	2	1	...	2	1	3	1	1	1	...	...	...	...	1	1	1	1	1	1	...	...	...	3		
2. Chronic Bronchitis	10	9	11	8	...	5	9	5	4	1	1	1	2	3	5	2	1	6	2	1	2	3	2	1	...	19	
3. Broncho-pneumonia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7	
4. Pneumonia	2	5	5	2	...	2	5	...	1	1	1	1	1	...	...	3	1	1	2	...	1	1	1	1	...	1	
5. Pleurisy	1	...	1	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	
6. Congestion of the Lungs	1	...	1	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	
7. Asthma and Emphysema	1	...	1	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	
8. Other Dis. of the Respir System.	24	20	26	18	...	13	20	11	8	1	1	1	1	1	1	4	6	6	11	7	6	4	7	2	1	...	44
Total	1	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	
VI. DIGESTIVE SYSTEM.	4	2	5	1	...	1	2	3	13	4	1	...	...	...	...	1	1	1	...	1	1	2	1	1	...	6	
1. Ulcer of the Stomach	8	9	16	1	...	17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	17	
2. Other Dis. of Stom (cancer exp'd)	5	2	3	3	1	2	2	3	1	2	1	1	1	1	1	2	1	1	...	...	...	1	2	1	...	7	
3. Infan. Diarr. and Cholera Infant'm	1	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	
4. Diarr. and Enteritis (not infant'e)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	
5. Dysentery .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
6. Hernia and Intestinal obstructions	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7. Other Diseases of the Intestines ..	4	4	6	2	...	1	4	3	...	...	...	...	...	...	...	1	2	1	1	...	1	1	...	...	...	8	
8. Diseases of the Liver	3	1	4	...	...	2	1	1	1	1	1	...	...	...	...	1	1	1	2	...	...	1	1	...	...	4	
9. Peritonitis (not puerperal)	2	...	2	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	
10. Iliac abscess and appendicitis ..	28	18	38	7	1	24	10	12	14	4	1	1	3	1	2	2	1	2	4	5	4	1	...	...	...	46	
Total	1	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	
VII. GENITO-URINARY SYSTM	9	5	7	7	...	3	8	3	...	...	...	...	...	...	...	1	3	3	1	2	1	1	2	2	1	...	14
1. Acute Nephritis .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2. Bright's Disease .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3. Other Dis. of Kidneys & Adnexa.	1	...	1	...	...	1	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	
4. Vesical Calculi .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5. Diseases of the Bladder .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6. Dis. of the male Genital Organs.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7. Metritis .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8. Other Diseases of the Uterus .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9. Ovarian Cysts & Ovarian Tumors.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10. Other Dis. of fem. Genital Organs	10	6	8	8	...	3	9	4	...	...	...	...	...	...	...	1	3	3	1	2	1	2	2	1	1	...	16
Total	2	...	1	1	...	2	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	2
VIII. PUERPERAL DISEASES.	1	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
1. Puerperal Septicæmia .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2. Puer'l Albuminuria and Convul.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3. Other acc. of Preg., sudden death	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4. Puerperal Disease of the Breast ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	3	...	2	1	...	3	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	3

CAUSES OF DEATHS BY COUNTIES IN 1898.—WENTWORTH.—POPULATION, 84,617. (Including Municipalities of all classes.)

General Diseases.		Number of Column.	Sex.		Nativity.		Sec. con.		Ages.												Months.												Totals.										
			Male.	Female.	Canada.	Foreign.	Not sta.	Single.	Married.	Not sta.	Under 5.						Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.															
											0-1.	1-2.	2-3.	3-4.	5-9.	10-14.													15-19.	20-24.	25-29.	30-34.		35-39.	40-44.	45-49.	50-59.	60-69.	70-79.	80 & ov.			
I. COMMUNICABLE DISEASES.			1	2	3	4	5	6	7	8	9													29	30	31	32	33	34	35	36	37	38	39	40	41							
1. Typhoid Fever.....			7	3		7	3		1	3	6													—	2	1	1	2										10					
2. Smallpox.....																																											
3. Measles.....																																											
4. Scarlet Fever.....			4	8		12			12																																		
5. Whooping Cough.....			1			1			1																																		
6. Diphtheria and Croup.....			13	18		31			31																3	2		1	6	3	1	2	4	3	6				12				
7. Influenza.....			2	1		1	2		1	2															1																31		
8. Other Epidemic Diseases.....																																									3		
Total.....			27	30		52	5		45	4	8														4	5	3	5	7	6	2	3	8	3	8				57				
II. OTHER GENERAL DISES.			6	14		13	7		4	6	10														2	2	2		3	3		2		1	3	2				20			
1. Pyæmia and Septicæmia.....																									15	7	11	18	10	14	10	14	11	12	5	13				140			
2. Malarial Fever.....			71	69		107	31	2	54	21	65														5	3	3	3	3	5	4	4	6		4					43			
3. Tuberculosis and Scrofula.....			20	23		18	25		15	28															2	1	3	1	1	1	1	1			9					9			
4. Syphilis.....			6	3		4	5		1	3	5																														5		
5. Cancer.....			1	4		3	2		1	1	3																														5		
6. Rheumatism and Gout.....			4	1		5			2	1	2																														1		
7. Diabetes.....																																										1	
8. Other General Diseases.....			1			1					1																															1	
9. Alcoholism, Acute and Chronic.....																																											1
Total.....			109	114		151	70	2	62	47	114														22	14	17	25	19	22	17	21	16	22	8	20				223			
Local Diseases.																																											
III. NERVOUS SYSTEM.																																											
1. Encephalitis.....			3	5		8			8																1	1																8	
2. Simple Meningitis.....			2	2		4			4																1	3		2														4	
3. Epid'ic Cerebro-spinal Meningitis.			8	6		11	3		10	1	3														1	2	1	7	5	6	5	9	1	4	1	1					14		
4. Congestion and Hem'age of Brain			19	29		16	32		219	27															6	1	2	1	7	5	6	5	9	1	4	1	1				48		
5. Softening of Brain.....			2	4		3	3		2	4															1	1		1	1	1	1	1	1	1	1	1					6		
6. Paralysis without specified cause.			18	15		11	22		112	20															3	3	3	3	3	4	1	3	6	1	5	3					33		
7. Insanity.....			6	8		7	7		2	3	9														3	1	1	2	1	2		1	1	1	1	1					14		
8. Epilepsy.....			1	2		1	2		1		2														1																	3	
9. Convulsions (not puerperal).....			8	13		18	3		18		3														2	3	2	2	1	2		5	1	3							21		
10. Other Nervous Diseases.....			2	2		2	1			4															1																		4
Total.....			69	86		81	73	1	48	39	68														20	8	11	11	18	14	17	13	15	13	6	9				155			
IV. CIRCULATORY SYSTEM.																																											
1. Pericarditis.....			2						1																																		2
2. Endocarditis.....			1	2		2	1			2															1																		3

YORK. — Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IV.—Continued.																																												
3.	Organic Heart Diseases	87	107		63	124	7	20	58	116	1		2		3	6	5	7	6	10	8	9	21	53	44	13				1	17	19	10	15	20	15	16	20	18	18	14	12	194	
4.	Angina Pectoris	2	4		3	3			1	1																																2		
5.	Arteries, Atheroma, Aneurism, etc	2	4		3	3			2	4																																6		
6.	Other Dis. of Circulatory System.	12	18		17	11	2	7	9	14			1		1	2	4	1	1	3	3	8	3																			30		
Total.....		108	142		96	145	9	37	73	140	1	1	1	2	7	11	8	10	10	9	14	13	13	30	59	47	14				22	26	15	19	26	18	19	26	22	21	21	15	250	
V. RESPIRATION.																																												
1.	Acute Bronchitis.....	28	27		50	5		50	5		40	5	2		2																													
2.	Chronic Bronchitis.....	11	13		6	18		37	8	4	21	9	3	1	2																													
3.	Broncho-pneumonia	25	24		37	12		37	8		23	9	6	2	1																													
4.	Pneumonia	97	70		95	69	3	51	38	78	23	9	6	2	5	2	4	4	6	12	7	9	10	34	23	6																		
5.	Pleurisy	2	3		3	2		1	2		1				1																													
6.	Congestion of the Lungs	12	8		11	6	3	9	4	7	5	2			1																													
7.	As hma and Emphysema.....	6	11		7	10		2	2	13	1																																	
8.	Other Dis. of Respiratory System																																											
Total.....		181	156		203	122	6	150	66	121	90	25	11	3	5	6	3	4	4	7	9	13	11	13	19	50	41				22	1	26	33	37	63	33	31	15	11	16	20	17	35
VI. DIGESTIVE SYSTEM.																																												
1.	Ulcer of the Stomach.....	1	3		2	2			2																																			
2.	Other Dis. of Stom. (cancer except'd)	14	8		8	14		2	6	14																																		
3.	Infan Diarr. and Cholera Infant'm	120	106		222	4		226			209	17																																
4.	Diarr'hæa & Enteritis (not infantile)	6	9		4	11		1	6	9																																		
5.	Dysentery	5	5		5	5		1	2	7																																		
6.	Hæmorrhæa and Intestinal obstructions	4	6		4	6		1	6	4																																		
7.	Other Diseases of the Intestines.....	1																																										
8.	Diseases of the Liver.....	16	16		14	17	1	2	10	20	1																																	
9.	Peritonitis (not puerperal)	21	38		38	16	5	17	17	25	1																																	
10.	Ilac abscess and appendicitis	14	5		15	4		8	1	10	1																																	
Total.....		201	197		312	79	7	256	51	91	212	17	1	1	6	8	12	12	11	8	6	8	28	28	20	12																		
VII. GENITO-URINARY SYSTEM																																												
1.	Acute Nephritis	16	7		15	8		9	12	12	4		1	2	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	398	
2.	Bright's Disease.....	37	49		35	49	2	8	38	40																																		
3.	Other Dis. of Kidneys & Adnexa.....	3			1	2		1																																				
4.	Vesical Calculi	4	7		6	5		2	5	4																																		
5.	Diseases of the Bladder	26	2		4	24		2	26																																			
6.	Dis. of the male Genital Organs.....																																											
7.	Metritis																																											
8.	Other Diseases of the Uterus																																											
9.	Ovarian Cysts & Ovarian Tumors																																											
10.	Other Dis. of fem. Genital Organs																																											
Total.....		86	70		63	91	2	20	51	85	4	1	2	1	3	6	7	8	3	4	10	8	14	33	34	17																		
VIII. PUERPERAL DISEASES.																																												
1.	Puerperal Septicæmia																																											

BELLEVEILLE. Continued

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IX. THE SKIN.																																												
1. Erysipelas		1			1			1			1																																	
2. Skin and Adnexa (Cancer except'd)																																												
X. LOCOMOTOR SYST'M. Total		1			1			1			1																																	
1. Pott's Disease.....																																												
2. Diseases of Bones and Joints																																												
3. Amputation (for unspecified Dis.)																																												
Total																																												
XI. MALFORMATIONS, ETC.																																												
1. Still-Births		2			2			2			2																																	
2. Congen. Debil. and Malformations		4	3		7			7			7																																	
3. Other Diseases of Infancy		1			1			1			1																																	
4. Senile Decay		10	5		4	11		4	11																																			
Total		17	8		14	11		10	4	11	9																																	
XII. SUICIDE. Total																																												
1. Poison																																												
2. Strangulation																																												
3. Gas Poisoning																																												
4. Drowning																																												
5. Firearms																																												
Total																																												
XIII. ACCIDENT. Total																																												
1. Fractures and Dislocations		1			1			1																																				
2. Gunshot																																												
3. Lightning																																												
4. Drowning																																												
5. Electric Cars																																												
6. Bicycles																																												
7. Railways		5			4	1		5																																				
8. Burns and Scalds		1			1			1																																				
9. Homicide																																												
10. Accidental Poisoning.....																																												
Total		6	1		6	1		2	5																																			
XIV. ILL-DEFINED CAUSES.																																												
1. Dropsy		1	3		2	2		1	1	2																																		
2. Tumors		1			1			1																																				
3. Other Ill-Defined Causes		2			1	1		1			1																																	
Total		4	3		4	3		3	1	3	1																																	
Total from all causes		73	76		107	39	3	59	50	27	2	1	4	5	5	5	6	7	7	4	4	4	6	8	9	17	23	14	14	13	16	11	10	12	9	17	14	10	16	8		149		

BRANTFORD. — Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41						
IV.—Continued.																																																
3. Organic Heart Diseases.....	7	4			5	6			2	9																																						
4. Angina Pectoris.....	1				1				1																																							
5. Arteries, Atheroma, Aneurism, etc																																																
6. Other Dis. of Circulatory System	1	2			3				2	1																																						
Total.....	11	6			9	8			1	4	12																																					
V. RESPIRATION.																																																
1. Acute Bronchitis.....																																																
2. Chronic Bronchitis.....																																																
3. Broncho-pneumonia.....																																																
4. Pneumonia.....	12	7			13	6			6	3	10																																					
5. Pleurisy.....																																																
6. Congestion of the Lungs.....	2	1			2	1			1	1	1																																					
7. Asthma and Emphysema.....	1					1																																										
8. Other Dis. of the Respir. System.																																																
Total.....	15	8			16	8			7	4	12																																					
VI. DIGESTIVE SYSTEM.																																																
1. Ulcer of the Stomach.....																																																
2. Other Dis. of Stom. (cancer except'd)	2	1				3																																										
3. Infan. Diarr. & Cholera Infantum	6	5			11				11																																							
4. Diarr. & Enteritis (not infantile).	2	1			1	2				1	2																																					
5. Dysentery.....																																																
6. Hernia and Intestinal obstructions	1					1				1																																						
7. Other Diseases of the Intestines..																																																
8. Diseases of the Liver.....	2	2			3	1				2	2																																					
9. Peritonitis (not puerperal).....	1	2			1	2				1																																						
10. Ilia abscess and appendicitis.....	2				2				2																																							
Total.....	16	12			19	9			13	6	9																																					
VII. GENITO-URINARY SYST.M.																																																
1. Acute Nephritis.....																																																
2. Bright's Disease.....	2	1			2	1				1	2																																					
3. Other Dis. of Kidneys & Adnexa.										3																																						
4. Vesical Calculi.....	1				1					1																																						
5. Dis. of the Bladder.....	4																																															
6. Dis. of the male Genital Organs..																																																
7. Metritis.....																																																
8. Other Diseases of the Uterus.....																																																
9. Ovarian Cysts & Ovarian Tumors																																																
10. Other Dis. of fem. Genital Organs																																																
Total.....	8	3			5	6					2	9																																				
VIII. PUERPERAL DISEASES.																																																
1. Puerperal Septicaemia.....																																																

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IX. THE SKIN.																																												
1. Erysipelas																																												
2. Skin and Adnexa (Cancer except)																																												
X. LOCOMOTOR SYSTM. Total																																												
1. Pott's Disease																																												
2. Dis-eases of Bones and Joints																																												
3. Amputation (for unspecified Dis.)																																												
XI. MALFORMATIONS, ETC. Total																																												
1. Still Births		3	5	3	11			11			11																			3	2		2					1	1	2	1	11		
2. Congen. Debil. and Malformations		3	4		7			7			7																															7		
3. Other Diseases of Infancy		6	6		2	10			3	9																			6	7		1	2		1	4	1					2		
4. Senile Decay		12	15	3	20	10		18	3	9	18																	5	7	3	3	3	2	1	5	2	4	2	2	3		30		
XII. SUICIDE. Total																																												
1. Poison																																												
2. Strangulation																																												
3. Gas Poisoning																																												
4. Drowning		1			1				1																																		1	
5. Firearms																																												
XIII. ACCIDENT. Total		1	1		2				1	1														1																			1	
1. Fractures and Dislocation																																												
2. Gas Poison																																												
3. Lightning																																												
4. Drowning		4			3	1		2	2			1																														4		
5. Electric Cars																																												
6. Bicycles																																												
7. Railways		1			1					1																																	1	
8. Burns and Scalds																																												
9. Homicide																																												
Total		6	1		6	1		2	1	4	1																																7	
XIV. ILL-DEFINED CAUSES.																																												
1. Dropsy																																												
2. Tumors																																												
3. Other Ill-Defined Causes																																												
Total																																												
Total from all causes		62	77	3	98	41	3	57	33	52	37	4	1	3	6	4	6	4	4	6	4	3	1	11	18	20	13	13		13	8	5	10	11	9	14	10	21	20	7	14	142		

KINGSTON.—Continued.

Number of Column.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
IV.—Continued.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
3.	Organic Heart Disease	8	9					2	7	8						1		1							2	4	5	3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

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General Diseases.	Sex.		Natv'ty.	Soc'l con.	Age.					Months.												Totals.							
	Male.	Female.			Canada.	Foreign.	Single.	Married.	Under 5.					Not g'n.	80 & ov.														
									0-1.	2.	3.	4.	5-9.			10-14.	15-19.	20-24.	25-29.	30-34.	35-39.	40-44.	45-49.	50-59.	60-69.	70-79.			
Number of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	41
I. COMMUNICABLE DISEASES.																													
1. Typhoid Fever.....	8	4		10	2		5	3	4						1	1					1	1							12
2. Smallpox.....	1			1			1																						1
3. Measles.....	4	5		9			9			1	1	1	5	1															9
4. Scarlet Fever.....	1			1			1			1	1	1	1																1
5. Whooping Cough.....	5	6		11			11			1	1	2	2	3	2														11
6. Diphtheria and Croup.....	3	1		2	1		2			1	1	1																	3
7. Influenza.....	1			1			1																						1
8. Other Epidemic Diseases.....																													1
Total.....	22	16		35	3		30	3	5	5	1	3	2	3	9	4	1	3		1	2		2	1	1				38
II. OTHER GENERAL DISS.																													
1. Pyæmia and Septicæmia.....	4	7		8	3		3	4	4	1					1		2	1											11
2. Malarial Fever.....	1			1			1																						1
3. Tuberculosis and Scrofula.....	24	40		52	12		31	8	25	9	2		1	1	8	9	13	4	2	4	1	5	2	1					64
4. Syphilis.....	6	10		6	10				9	7																			16
5. Cancer.....	1																												4
6. Rheumatism and Gout.....	4			2	2		2	2							1	1	1												4
7. Diabetes.....	2			2			2																						2
8. Other General Diseases.....	1			1			1																						2
9. Alcoholism, Acute and Chronic.....																													1
Total.....	35	64		72	27		38	24	37	11	2		1	2	1	9	11	16	6	3	5	3	14	7	7				99
Local Diseases.																													
III. NERVOUS SYSTEM.																													
1. Encephalitis.....	2	1		2	1		3			1	1																		3
2. Simple Meningitis.....	7	2		9			9			6	2	1																	9
3. Epid c. Cerebro-spinal Meningitis.....	1			1			1																						1
4. Congestion & Hemor'ge of Brain.....	11	13		6	18		1	7	16						1	1	3		1	1	2	4	8	3					24
5. Softening of the Brain.....	1			1			1																						1
6. Paralysis without specified cause.....	7	9		2	14		1	4	11						1														16
7. Insanity.....	1	2		1	2		1	1																					3
8. Epilepsy.....	9	5		13	1		13			8	2	1																	3
9. Convulsions (not puerperal).....																													14
10. Other nervous Diseases.....																													1
Total.....	37	34		34	37		29	13	29	15	4	5	1		3	1	1	3		1	3	5	8	15	6				71
IV. CIRCULATORY SYSTEM.																													
1. Pericarditis.....	1			1																									1
2. Endocarditis.....																													

3. Organic Heart Diseases.	5 10	8 6 1	1 9 5	1 1 1	1 1 1	3 3 1	1 1 1	1 1 1	15
4. Angina Pectoris	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	3
5. Arteries, Atheroma, Aneurism, &c.	7 12	10 8 1	2 10 7	1 1 1	1 1 1	3 3 2	2 1 5 1	1 1 1	19
6. Other Dis. of Circulatory System.	4 2	6	5	4 1	1 1 1	2 2 1	1 1 1	1 1 1	6
V. RESPIRATION.	2 2	1 3	2 2	2 2	1 1 1	1 1 1	1 1 1	1 1 1	4
1. Acute Bronchitis	3	1 2	3	2	1 1 1	1 1 1	1 1 1	1 1 1	3
2. Chronic Bronchitis	6 5	6 4 1	4 2 5	2 2	1 1 1	1 1 1	1 1 1	1 1 1	11
3. Broncho-pneumonia	1	1	1	1	1 1 1	1 1 1	1 1 1	1 1 1	1
4. Pneumonia	13 12	15 9 1	10 7 8	7 1 2	1 1 1	1 1 1	1 2 3 6	1 1 1	25
5. Pleurisy	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
6. Congestion of the Lungs	2 4	6	6	4 2	1 1 1	1 1 1	1 1 1	1 1 1	2
7. Asthma and Emphysema	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	6
8. Other Dis. of Respiratory System	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	2
VI. DIGESTIVE SYSTEM.	1 3	1 3	2 2	2 2	2 2	2 2	2 2	2 2	1
1. Ulcer of the Stomach	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	4
2. Other Dis. of Stom. (cancer exp'd)	2 4	6	6	4 2	1 1 1	1 1 1	1 1 1	1 1 1	1
3. Infan. Diarrh. & Cholera Infantm.	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	4
4. Diarrh. & Enteritis (not infantile)	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
5. Dysentery	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
6. Ile-ria and Intestinal obstructions	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
7. Other Diseases of the Intestines.	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
8. Diseases of the Liver	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
9. Peritonitis (not puerperal)	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
10. Iliac abscess and appendicitis.	7 10	10 7	7 5 5	4 2	2 4	1 1 1	1 1 1	1 1 1	17
VII. GENITO-URINARY SYS'M.	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	2
1. Acute Nephritis	3	2 1	3	3	2 1	1 1 1	1 1 1	1 1 1	3
2. Bright's Disease	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
3. Other Dis. of Kidneys & Adnexa.	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
4. Vesical Calculi	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
5. Diseases of the Bladder	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
6. Dis. of the male Genital Organs.	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
7. Metritis	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
8. Other Diseases of the Uterus	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
9. Ovarian Cysts & Ovarian Tumors	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
10. Other Dis. of fem. Genital Organs	4 2	3 3	2 4	2 4	1 1 1	1 1 1	1 1 1	1 1 1	6
Total	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
VIII. PUERPERAL DISEASES.	2 2	1 1	2 2	2 2	2 2	2 2	2 2	2 2	2
1. Puerperal Septicaemia	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
2. Puerl Albuminuria and Convul.	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	2
3. Other acc. of Preg., sudden death	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	1
4. Puerperal Disease of the Breast	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	3
Total	1 1	1 1	1 1	1 1	1 1 1	1 1 1	1 1 1	1 1 1	3

		Number of Column.																																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41			
IX. THE SKIN.																																													
1. Erysipelas																																													
2. Skin and Adnexa (cancer except'd)																																													
X. LOCOMOTOR SYST'M. Total																																													
1. Pott's Disease																																													
2. Diseases of Bones and Joints.....																																													
3. Amputation (for unspecified Dis.)																																													
Total																																													
XI. MALFORMATIONS, ETC.																																													
1. Still Births		4	5		9			9		9																																		9	
2. Congen. Debi'l & Malformations.		9	6		15			15		15																																		15	
3. Other Diseases of Infancy		3	5		3	5		3	5																																			8	
4. Senile Decay																																													
Total		16	16		27	5		24	3	5	24																																	32	
XII. SUICIDE.																																													
1. Poison.....																																													
2. Strangulation																																													
3. Gas Poisoning																																													
4. Drowning																																													
5. Firearms																																													
XIII. ACCIDENTS. Total																																													
1. Strangulation		1			1			1																																				1	
2. Fractures and Dislocations		1			1			1																																			1		
3. Gunshot																																													
4. Lightning																																													
5. Drowning		3			2	1		1	2																																		3		
6. Electric Cars																																													
7. Bicycles		1								1																																		1	
8. Railways																																													
9. Burns and Scalds.....																																													
Total		5	1		4	2		3	3																																		6		
XIV. ILL-DEFINED CAUSES.																																													
1. Dropsy																																													
2. Tumor.....																																													
3. Other Ill-Defined Causes		1			1			1																																				1	
4. Lockjaw																																													
Total		1	2		2	1		1	1	1																																	3		
Total from all causes.....		83	84		116	3		65	47	55	43	4	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	167		

CAUSES OF DEATHS BY CITIES IN 1898.—ST. THOMAS.—POPULATION 11,120.

General Diseases.	Number of Column.	Sex.		Nativity.		Soc. con.	Age.												Months.												Totals.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		Male.	Female.	Canada.	Foreign.		Not sta.	Under 5.					10-14.	15-19.	20-24.	25-29.	30-34.	35-39.	40-49.	50-59.	60-69.	70-79.	80 & ov.	Nov & Dec.	Jan.	Feb.	Mar.	April.	May.	June.		July.	Aug.	Sep.	Oct.	Nov.	Dec.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
								0-1.	1-2.	2-3.	3-4.	5-9.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
I. COMMUNICABLE DISEASES.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
1. Typhoid Fever.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

STRATFORD.—Continued.

Number of Column.																																								
IX. THE SKIN.																																								
1. Erysipelas																																								
2. Skin and Adnexa (Cancer excepted)																																								
X. LOCOMOTOR SYSTEM. Total																																								
1. Pott's Disease																																								
2. Diseases of Bones and Joints																																								
3. Amputation (for unspecified Dis.)																																								
XI. MALFORMATIONS, ETC.																																								
1. Still Births																																								
2. Congen. Debil. and Malformations																																								
3. Other Diseases of Infancy																																								
4. Senile Decay																																								
Total																																								
XII. SUICIDE. Total																																								
1. Strangulation																																								
2. Gas Poisoning																																								
3. Drowning																																								
4. Firearms																																								
XIII. ACCIDENT. Total																																								
1. Fractures and Dislocations																																								
2. Gunshot																																								
3. Lightning																																								
4. Drowning																																								
5. Electric Cars																																								
6. Bicycles																																								
7. Railways																																								
8. Burns and Scalds																																								
9. Homicide																																								
10. Strangulation																																								
11. Poison																																								
Total																																								
XIV. ILL-DEFINED CAUSES.																																								
1. Dropsy																																								
2. Tumors																																								
3. Other Ill-Defined Causes																																								
Total																																								
Total from all causes																																								

clxxxviii.

IV.—Continued.

3. Organic Heart Diseases	69	79	..	43	101	4	16	40	92	1	..	2	..	3	4	5	6	6	9	8	6	17	39	26	10	1	15	17	8	10	15	10	16	13	13	11	10	148
4. Angina Pectoris	2	..	..	2	..	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	2
5. Arteries, Atheroma, Aneurism, etc	1	4	..	2	3	..	1	4	..	..	..	..	..	..	..	..	..	..	1	1	..	1	2	..	..	1	2	..	..	..	..	..	..	..	..	1	5
6. Other Dis. of Circulatory System.	9	13	..	11	10	1	6	12	..	1	..	1	..	1	..	1	3	1	1	3	2	7	2	..	..	..	3	1	2	3	1	3	2	1	2	4	22

Total

V.	R.
1. Acute Bronchitis.
2. Chronic Bronchitis.
3. Broncho-pneumonia
4. Pneumonia
5. Pleurisy
6. Congestion of the Lungs
7. Asthma and Emphysema.
8. Other Dis. of Respiratory System

Total

VI. DIGESTIVE SYSTEM.									
1.	Ulcer of the Stomach.....	1	3	2	2	2	2	2	2
2.	Other Dis of Stom. (cancer exclud.)	13	6	11	..	..	..	..	..
3.	Infan. Diarrh. & Cholera Infant m	102	80	18	9	173	9	..	..
4.	Diarrh. & Enteritis (not infantile)	5	8	3	10	..	..	..	..
5.	Dysentery.....	2	1	2	2	..	..	..	..
6.	Hernia and Intestinal obstructions	3	6	3	6	..	..	..	..
7.	Other Diseases of the Intestines.	3	1	1	..	..	..	..	..
8.	Diseases of the Liver.....	14	12	10	15	1	2	6	18
9.	Pentomitis (not puerperal).....	15	34	33	12	4	17	13	19
10.	Iliac abscess and appendicitis....	12	4	13	3	..	7	1	8

VII GENITO-URINABV SVS'M

[illegible]

Total

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1	2	3	4	5	6	7	8	9	Not sta.	0-1	1	2	3	4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49		50-59	60-69	70-79	80 & ov.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
I. COMMUNICABLE DISEASES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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BERLIN.—Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41							
IV.—Continued.																																																	
3.	Organic Heart Diseases																																																
4.	Angina Pectoris				1	1																																											
5.	Arteries, Atheroma, Aneurism, etc																																																
6.	Other Dis. of Circulatory System																																																
V. RESPIRATION. Total		2			1	1				2																																							
1.	Acute Bronchitis	3			1	2				1																																							
2.	Chronic Bronchitis		1						1																																								
3.	Broncho pneumonia																																																
4.	Pneumonia		3			2	1		2																																								
5.	Pleurisy																																																
6.	Congestion of the Lungs		1			1			1																																								
7.	Asthma and Emphysema																																																
8.	Other Dis. of the Respir System																																																
Total		4	4		4	4		4	2	2	3																																						
VI. DIGESTIVE SYSTEM.																																																	
1.	Ulcer of the Stomach																																																
2.	Other Dis. of Stom (cancer exp'd)																																																
3.	Infan. Diarr. & Cholera Infantum	4	2		6			6			6																																						
4.	Diarr. & Enteritis (not infantile).		1		1			1																																									
5.	Dysentery					1			1																																								
6.	Hernia and Intestinal obstructions																																																
7.	Other Diseases of the Intestines		1							1																																							
8.	Diseases of the Liver																																																
9.	Peritonitis (not puerperal)		2		2				1																																								
10.	Iliac abscess and appendicitis			1		1			1																																								
Total		5	7		10	2		9	2	1	6																																						
VII. GENITO-URINARY SYSM.																																																	
1.	Acute Nephritis																																																
2.	Bright's Disease																																																
3.	Other Dis. of Kidneys & Adnexa.																																																
4.	Vesical Calculi																																																
5.	Diseases of the Bladder																																																
6.	Dis. of the male Genital Organs																																																
7.	Metritis																																																
8.	Other Diseases of the Uterus																																																
9.	Ovarian Cysts & Ovarian Tumors																																																
10.	Other Dis. of fem. Genital Organs																																																
Total		5	2		2	5		1		6																																							
VIII. PUERPERAL DISEASES.																																																	
1.	Puerperal Septicemia																																																
2.	Puerl Albuminuria and Convul.																																																

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IX. THE SKIN.																																												
1. Erysipelas																																												
2. Skin and Adenæ (Cancer except'd)																																												
X. LOCOMOTOR SYST'M. Total																																												
1. Pott's Disease																																												
2. Diseases of Bones and Joints																																												
3. Amputation (for unspecified Dis)																																												
XI. MALFORMATIONS, ETC. Total																																												
1. Still-Births																																												
2. Congen. Debil. & Malformations.																																												
3. Other Diseases of Infancy																																												
4. Senile Decay																																												
XII. SUICIDE. Total																																												
1. Poison																																												
2. Strangulation																																												
3. Gas Poisoning																																												
4. Drowning																																												
5 Firearms																																												
XIII. ACCIDENT. Total																																												
1. Fractures and Dislocations																																												
2. Gunshot																																												
3. Lightning																																												
4. Drowning																																												
5. Electric Cars																																												
6. Bicycles																																												
7. Railways																																												
8. Burns and Scalds																																												
9. Homicide																																												
10. Gas Poisoning																																												
XIV. ILL-DEFINED CAUSES. Total																																												
1. Dropsy																																												
2. Tumors																																												
3. Other Ill-Defined Causes																																												
Total.....																																												
Total from all causes....																																												

LINDSAY. —Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IX. THE SKIN.																																												
1. Erysipelas																																												
2. Skin and Adnexa (Cancer except'd)																																												
X. LOCOMOTOR SYSTEM.																																												
1. Pott's Disease																																												
2. Diseases of Bones and Joints																																												
3. Amputation (for unspecified Dis.)																																												
XI. MALFORMATIONS, ETC.																																												
1. Still Births		1	3		4			4		4				4																														4
2. Congen. Debil. and Malformations		6	3		8	1		8	1	9																																	9	
3. Other Diseases of Infancy		6	4		2	8			1	9																																	10	
4. Senile Decay		13	10		14	9		12	1	10				13																													23	
XII. SUICIDE. Total.....																																												23
1. Poison.....																																												
2. Strangulation.....																																												
3. Gas Poisoning																																												
4. Drowning																																												
5. Firearms																																												
XIII. ACCIDENT. Total.....																																												
1. Fractures and Dislocations																																												
2. Gunshot.....																																												
3. Lightning																																												
4. Drowning		2			2			1	1																																		2	
5. Electric Cars																																												
6. Bicycles																																												
7. Railways																																												
8. Burns and Scalds																																												
9. Homicide.....																																												
10. Poison.....																																												
XIV. ILL-DEFINED CAUSES. Total.....		2			2			1	1																																		2	
1. Dropsy																																												
2. Tumors		2			2			1	1																																		2	
3. Other Ill-Defined Causes																																												
Total		2			2			1	1																																		2	
Total from all causes.....		41	49		66		24		33	23	3	1	1	1	1		5	3	7	4	3	3	6	5	5	9	10		6	4	6	7	10	6	9	5	9		7	11		90		

NIAGARA FALLS.—Continued.

Number of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
IV.—Continued.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
3. Organic Heart Diseases	1	1		2				2												1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

CAUSES OF DEATHS BY TOWNS IN 1898.—OWEN SOUND.—POPULATION, 8,041.

General Diseases.	Number of Column.	Sex.		Natv'ty.		Soc'l con.		Ages.										Month.												Totals.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
		Male.	Female.	Canada.	Foreign.	Not sta.	Single.	Married.	Under 5.						10-14.	15-19.	20-24.	25-29.	30-34.	35-39.	40-44.	45-49.	50-59.	60-69.	70-79.	80 & ov.	Not R'vd.	Jan.	Feb.		March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
									0-1.	1.	2.	3.	4.	5-9.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
I. COMMUNICABLE DISEASES.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
1. Typhoid Fever		1	3	4		2	2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		</

OWEN SOUND . *Continued.*

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41			
IX. THE SKIN.																																													
1.	Erysipelas																																												
2.	Skin and Adnexa (Cancer except'd)																																												
X. LOCOMOTOR SYSTEM. Total																																													
1.	Pott's Disease	1			1			1																																					
2.	Diseases of Bones and Joints																																												
3.	Amputation (for unspecified Dis.)																																												
Total																																													
XI. MALFORMATIONS, ETC.																																													
1.	Still-Births	3	4		7			7			7																																		
2.	Coegen, Debil. and Malformations	6	3		9			9			9																																		
3.	Other Diseases of Infancy																																												
4.	Senile Decay	8	8		2	14		8	8																																				
Total		17	15		18	14		16	8	8																																			
XII. SUICIDE.																																													
1.	Poison	1			1			1																																					
2.	Strangulation																																												
3.	Gas Poisoning																																												
4.	Drowning	1			1			1																																					
5.	Firearms																																												
Total		1	2		3			1	1	1																																			
XIII. ACCIDENT.																																													
1.	Fractures and Dislocations	1			1			1																																					
2.	Gunshot																																												
3.	Lightning																																												
4.	Drowning	3			2	1		2		1																																			
5.	Electric Cars																																												
6.	Bicycles																																												
7.	Railways																																												
8.	Burns and Scalds																																												
9.	Homicide																																												
10.	Accidental Poisoning																																												
Total		3	1		3	1		2	1	1																																			
XIV. ILL-DEFINED CAUSES.																																													
1.	Dropsy																																												
2.	Tumors																																												
3.	Other Ill-Defined Causes	1												</																															

CAUSES OF DEATHS BY TOWNS IN 1898.—RAT PORTAGE.—POPULATION, 4,545.

General Diseases.		Number of Column.	Sex.		Nativity		Soc. con.		Ages.										Months.												Totals.						
			Male.	Female.	Canada.	Foreign.	Single.	Married.	Under 5.																												
									0-1.	1-2.	2-3.	3-4.	5-9.	10-14.	15-19.	20-24.	25-29.	30-34.	35-39.	40-44.	45-49.	50-59.	60-69.	70-79.	80 & ov.	Not given.	Jan.	Feb.	March.	April.		May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
			1	2	3	4	5	6	7	8	9																									41	
I. COMMUNICABLE DISEASES.																																					
1. Typhoid Fever.....			9	3		6	1	5		8	3	1																									12
2. Smallpox.....									1																												1
3. Measles.....				1					1																												2
4. Scarlet Fever.....			1	1			2																														1
5. Whooping Cough.....																																					
6. Diphtheria and Croup.....			1				1																														1
7. Influenza.....																																					
8. Other Epidemic Diseases.....																																					
Total.....			11	5		6	1	9		12	3	1																									16
II. OTHER GENERAL DISS.																																					
1. Pyæmia and Septicæmia.....			2	2		1	1	2		3	1																										4
2. Malarial Fever.....																																					
3. Tuberculosis and Scrofula.....			3	7		4		6		7	1	2																									10
4. Syphilis.....																																					
5. Cancer.....			1				1																														1
6. Rheumatism and Gout.....			1			1				1																											1
7. Diabetes.....																																					
8. Other General Diseases.....			2			1		1		2																											2
9. Alcoholism, Acute and Chronic.....																																					
Total.....			9	9		7	2	9		13	3	2																									18
Local Diseases.																																					
III. NERVOUS SYSTEM.																																					
1. Encephalitis.....			1			1				1																											1
2. Simple Meningitis.....																																					
3. Epidic Cerebro-spinal Meningitis.....																																					
4. Congestion and Hemor'gs of Brain.....			2			1		1		1	1																										2
5. Softening of Brain.....																																					
6. Paralysis without specified cause.....			1				1			1																											1
7. Insanity.....																																					
8. Epilepsy.....																																					
9. Convulsions (not puerperal).....			1	1			2																														2
10. Other Nervous Diseases.....																																					
Total.....			4	2		2		4		5	1																										6
IV. CIRCULATORY SYSTEM.																																					
1. Pericarditis.....																																					
2. Endocarditis.....																																					

RAT PORTAGE.—Continued.

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IX. THE SKIN.																																												
1. Erysipelas.....																																												
2. Skin and Adnexa (Cancer except)																																												
X. LOCOMOTOR SYSTM. Total.																																												
1. Pott's Disease.....																																												
2. Diseases of Bones and Joints.....																																												
3. Amputation (for unspecified Dis.)																																												
Total																																												
XI. MALFORMATIONS, ETC.																																												
1. Still Births.....																																												
2. Congen Debil. and Malformations																																												
3. Other Diseases of Infancy.....																																												
4. Senile Decay.....																																												
Total																																												
XII. SUICIDE. Total.																																												
1. Poison.....																																												
2. Strangulation.....																																												
3. Gas Poisoning.....																																												
4. Drowning.....																																												
5. Firearms.....																																												
XIII. ACCIDENT. Total.																																												
1. Fractures and Dislocations.....																																												
2. Gas Poison.....																																												
3. Lightning.....																																												
4. Drowning.....																																												
5. Electric Cars.....																																												
6. Bicycles.....																																												
7. Railways.....														</																														

Number of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
IX. THE SKIN.																																												
1. Erysipelas																																												
2. Skin and Adnexa (Cancer except'd)																																												
X. LOCOMOTOR SYSTM. Total																																												
1. Pott's Disease																																												
2. Diseases of Bones and Joints																																												
3. Amputation (for unsupected Dis.)																																												
XI. MALFORMATIONS, ETC.																																												
1. Still Births																																												
2. Congen. Debil. and Malformations																																												
3. Other Diseases of Infancy																																												
4. Senile Decay																																												
XII. SUICIDE. Total																																												
1. Poison																																												
2. Strangulation																																												
3. Gas Poisoning																																												
4. Drowning																																												
5. Firearms																																												
XIII. ACCIDENTS. Total																																												
1. Fractures and Dislocations																																												
2. Gunshot																																												
3. Lightning																																												
4. Drowning																																												
5. Electric Cars																																												
6. Bicycles																																												
7. Railways																																												
8. Burns and Scalds																																												
9. Homicide																																												
XIV. ILL-DEFINED CAUSES. Total																																												
1. Dropsy																																												
2. Tumors																																												
3. Other Ill-Defined Causes																																												
Total																																												
Total from all causes																																												

CAUSES OF DEATHS BY TOWNS IN 1898.—WOODSTOCK.—POPULATION, 9,238.

General Diseases.		Sex.	Nat'vty.	Soc'l con.	Ages.										Months.										Totals.																	
Number of Column.					Under 5.																																					
Male.	Female.	Not sta.	Canada.	Foreign.	Not sta.	Single.	Married.	Not sta.	0-1.	1.	2.	3.	4.	5-9.	10-14.	15-19.	20-24.	25-29.	30-34.	35-39.	40-44.	45-49.	50-59.	60-69.	70-79.	80 & ov.	Not sta.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40			
I. COMMUNICABLE DISEASES.																																										
1. Typhoid Fever.....		2		2		2								1																	1											
2. Smallpox.....																																										
3. Measles.....																																										
4. Scarlet Fever.....																																										
5. Whooping Cough.....																																										
6. Diphtheria and Croup.....																																										
7. Influenza.....																																										
8. Other Epidemic Diseases.....																																										
Total.....		2		2		2								1																	1											
II. OTHER GENERAL DISEASES.																																										
1. Pyæmia and Septicæmia.....		4	1	5		1	1	3																																		
2. Malarial Fever.....																																										
3. Tuberculosis and Scrofula.....		8	3	10	1	2	2	7						1				2	2	1	1	1	1	1	1	1	1	1	1	1	3	3	1									
4. Syphilis.....																																										
5. Cancer.....		2	1	1	2			1	2									1																								
6. Rheumatism and Gout.....																																										
7. Diabetes.....																																										
8. Other General Diseases.....		1		1		1																																				
9. Alcoholism, Acute and Chronic.....																																										
Total.....		14	6	17	3	4	4	12	1	1				1			2	3	2	1	3	2	1	4	2			2	1	1	3	4	2	1								
Local Diseases.																																										
III. NERVOUS SYSTEM.																																										
1. Encephalitis.....		1	1	2		1	1							1																												
2. Simple Meningitis.....				1																																						
3. Epidic Cerebro-spinal Meningitis.....																																										
4. Congestion and Hemor'ge of Brain.....				2				2																																		
5. Softening of Brain.....																																										
6. Paralysis without specified cause.....		2						2																																		
7. Insanity.....																																										
8. Epilepsy.....																																										
9. Convulsions (not puerperal).....		1	1	2		2																																				
10. Other Nervous Diseases.....																																										
Total.....		5	5	7	3	4	2	4	2					1			1	1	1													3	2	1	2							
IV. CIRCULATORY SYSTEM.																																										
1. Pericarditis.....																							</																			

1V.—Continued.

3. Organic Heart Disease
4. Angina Pectoris
5. Arteries, Atheroma, Aneurism, etc
6. Other Dis. of Circulatory System.

Total.

- ### V. RESPIRATION.
1. Acute Bronchitis.....
 2. Chronic Bronchitis.....
 3. Broncho-pneumonia.....
 4. Pneumonia.....
 5. Pleurisy.....
 6. Congestion of the Lungs.....
 7. Asthma and Emphysema.....
 8. Other Dis. of Respiratory System.....

• Total
VI. DIGESTIVE SYSTEM

1. Ulcer of the Stomach.....
2. Other Dis. of Stom.(cancer exp'd)
3. Infan. Diar. & Cholera Infantum.
4. Diarr. & Enteritis (not infantile).
5. Dysentery.....
6. Hernia and Intestinal obstructions
7. Other Diseases of the Intestines.
8. Diseases of the Liver.....
9. Peritonitis (not puerperal).....
10. Iliac abscess and appendicitis....

Total

- VII. GENITO-URINARY SYSTEM.
1. Acute Nephritis.
 2. Acute Nephrosis.
 2. Bright's Disease.
 3. Other Dis. of Kidneys & Adnexa.
 4. Vesical Calculi.
 5. Diseases of the Bladder.
 6. Dis. of the male Genital Organs.
 7. Menstris.
 8. Other Diseases of the Uterus.
 9. Ovarian Cysts & Ovarian Tumors.
 9. Other Dis. of fem. Genital Organs.

Total:

- VIII. PUERPERAL DISEASES.
1. Puerperal Septicaemia

[illegible]

49691
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